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Recorded are minutes of hearings before the House Ad Hoc Select Subcommittee on Maritime Education and Training regarding the sea training of United States Merchant Marine officers. Examined are various approaches to meeting the sea training requirement, especially the options of maritime academy training vessels, sailing on U.S.-flag merchant ships, the role of smaller vessels and the use of simulators. Presented are the oral testimony of 27 witnesses, along with additional material and communications submitted. (WB)

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SEA TRAINING AT MARITIME ACADEMIES OVERSIGHT

HEARINGS

BEFORE THE

AD HOC SELECT SUBCOMMITTEE ON MARITIME EDUCATION AND TRAINING

OF THE

COMMITTEE ON MERCHANT MARINE AND FISHERIES HOUSE OF REPRESENTATIVES

NINETY-SIXTH CONGRESS

SECOND SESSION

ON

SEA TRAINING OF UNITED STATES MERCHANT MARINE OFFICERS AND DIFFERENT WAYS OF SATISFYING THIS REQUIREMENT AT THE VARIOUS MARITIME ACADEMIES

SEPTEMBER 9, 1980

Serial No. 96–52

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CONTENTS

	Page
Hearing held September 9, 1980	1
Statement of—	
Bell, Rear Adm. Henry H., Chief, Office of Merchant Marine Safety, U.S. Coast Guard	3
Benkert, Adm. William M., USCG (Ret.), president, American Institute of Merchant Shipping	43
Brown, Donald G., manager, marine and industry coordination, Marine Department of Gulf Trading & Transportation Co., a division of Gulf Oil Corp	89
Davis, John, Chief, Division of Ship Management, Maritime Administration	20
Federal Aviation Administration	207
Friedberg, Arthur, Director, Office of Maritime Labor and Training, Maritime Administration	27, 98
Gleske, Elmer G., vice president for governmental affairs, Flight-Safety International	112
Prepared statement	120
Hard, Douglas A., director, Marine Safety International	112
Prepared statement	120
Hendy, Commodore William R., Jr., acting president, Massachusetts Maritime Academy	3, 47, 66
Kelly, Ed, Marine Engineers Beneficial Association, district 2; special assistant to the president	131
Kinney, Rear Adm. S. H., USN (Ret.), president, State University of New York Maritime College, Fort Schuyler, N.Y	47, 67
Prepared statement	68
Krinsky, Capt. Paul, USMS, Academic Dean, U.S. Merchant Marine Academy	27, 31
Prepared statement	33
Lowen, Capt. Robert J., president, International Organization of Masters, Mates & Pilots, ILA, AFL–CIO	84
Mason, John A., director of vocational education, the Seafarers' Harry Lundeberg School of Seamanship	81
Mayberry, Capt. William, executive director, Offshore Marine Services Association	99
McAllister, Bruce, Deputy Assistant Secretary for Maritime Affairs, Maritime Administration, Department of Commerce	3, 27
Prepared statement	28
McCowen, Comdr. S. D., Chief, Merchant Vessel Personnel Manning Branch, U.S. Coast Guard	99
Miller, Eugene R., Jr., vice president, Hydronautics, Inc	112
Prepared statement	114
Motte, Capt. Geoffrey, vice president of academic affairs, Massachusetts Maritime Academy	47, 66
Muth, Capt. Harold, vice president of government relations, American Waterways Operators	97
Pesch, Alan, president, Ship Analytics	112
Prepared statement	122
Rector, Rear Adm. George B., director, Great Lakes Maritime Academy	201
Rich, Capt. William L., Jr., director of research and training; maritime advancement, training, education, and safety program; Master, Mates & Pilots	81, 83
Rizza, R. Adm. J. P., USMS, president, California Maritime Academy	47
Prepared statement	52

Statement of——Continued
Page
Rodgers, Rear Adm. E. A., USMS, superintendent, Maine Maritime Academy 47, 60
Prepared statement 64
Sea-Land Industries, Investments, Inc 197
Trimble, Vice Adm. Paul E., USCG (Ret.), president, Lake Carriers' Association 89
Prepared statement 90
Additional material supplied—
Coast Guard: Questions of Mr. AuCoin and responses 156
Commerce Department: Questions of Mr. AuCoin and answers thereto 136
Mayberry, Capt. William: Comparison chart of sea service for licensing requirements in the offshore marine services industry 103
Rizza, Rear Adm. J. P.: Article: "CMA Tanker Simulator" 59
Communications submitted—
Craig, Larry S.: Letter of November 14, 1980, to Hon. Les AuCoin 155
Friedberg, Arthur W.: Letter of April 28, 1980, to Rear Adm. Henry H. Bell 36
Gleske, Elmer G.: Letter of October 27, 1980, to Hon. Les AuCoin with response to questions 189
Haynes, Rear Adm. Kenneth G.: Letter of August 22, 1980, to Hon. Les AuCoin 204
Hendy, Commodore William R., Jr.: Letter of October 23, 1980, to Hon. Les AuCoin with responses to questions 184
Hiltzheimer, Charles I.: Letter of September 5, 1980 196
Kinney, Rear Adm. Sheldon H.: Letter of October 31, 1980, to Hon. Les AuCoin with responses to questions 186
McAllister, Bruce A.: Letter of November 14, 1980, to Hon. Les AuCoin 135
Miller, Eugene R., Jr.: Letter of October 28, 1980, to Hon. Les AuCoin with responses to questions 194
Muth, Harold D.: Letter of October 15, 1980, to Hon. Les AuCoin 188
Pesch, Alan J.: Letter of October 30, 1980, to Hon. Les AuCoin with responses to questions 191
Rector, Rear Adm. George B.: Letter of November 26, 1980, to Hon. Les AuCoin with answers to questions 178
Rizza, Rear Adm. J. P.: Letter of October 28, 1980, to Hon. Les AuCoin containing answers to questions posed 168
Rodgers, Rear Adm. E. A.: Letter of October 24, 1980, to Hon. Les AuCoin with responses to questions 181

SEA TRAINING AT MARITIME ACADEMIES OVERSIGHT

TUESDAY, SEPTEMBER 9, 1980

HOUSE OF REPRESENTATIVES,
AD HOC SELECT SUBCOMMITTEE ON
MARITIME EDUCATION AND TRAINING,
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D.C.

The subcommittee met, pursuant to notice, at 9:40 a.m., in room 1334, Longworth House Office Building, Hon. Les AuCoin (chairman of the subcommittee) presiding.

Present: Representatives AuCoin, Akaka, Emery, and Studds.

Mr. AUCOIN. The subcommittee will come to order.

Today this subcommittee devotes its attention to the sea training of U.S. merchant marine officers and different ways of satisfying this requirement.

Earlier this year, in additional views to the committee report on the Maritime Reauthorization Act, I indicated that the IMCO Convention on Standards of Training, Certification, and Watchkeeping for Seafarers forces us to take a closer look at the requirements our Government has agreed to support internationally and precisely how these requirements will be interpreted by the U.S. Coast Guard for licensing purposes.

The subcommittee welcomes the attentive interest with which the Federal agencies, the academies, the industrial sector, and the labor force of the U.S. merchant marine responded to its invitation to testify on sea training. During my term as chairman of this ad hoc subcommittee, I have learned that there are many different approaches our educational institutions may pursue as they prepare future merchant seafarers to meet our maritime standards of safety and efficiency.

Our goal today is to examine those different approaches to meeting the sea training requirement, most importantly the options of maritime academy training vessels, sailing on U.S.-flag merchant ships, the role of smaller vessels and the use of simulators.

The record we build during today's oversight hearing will serve as a basis for future legislation and maritime policy. It will guide the administration's implementation of the IMCO Convention, a process that has already begun through interagency meetings between Marad (Maritime Administration), the Coast Guard, and the State and Federal maritime academies. This was one of my suggestions contained in my additional views on H.R. 6554. We welcome the confirmation of this in testimony from these organizations today.

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This oversight hearing will also guide the educational institutions, it is hoped, in the most cost-effective preparation of their students as we examine different approaches to at-sea training. The IMCO Convention mandates a substantial increase in the amount of sea training time for initial licensing of deck officers.

How the Federal Government and the academies shall meet this increase in time remains a challenge to be met. Simulator training is one very probable component of that training, yet it will require serious commitments by educators and policymakers alike to a new and not inexpensive technology.

So that we may proceed in an orderly and efficient manner, may I ask each of the witnesses on the five panels to present a short summary of your written testimony. Please keep in mind that the subcommittee is primarily concerned with the sea-training problems that have arisen as a result of the IMCO Convention and precisely how in the judgment of the witnesses those problems can best be overcome.

Each witness may be assured that his entire written statement will be included in the hearing record. Upon the conclusion of today's hearings, the subcommittee will carefully review the entire record and most of you will receive written questions for your further response. These questions and answers will also be included in the printed hearing record. Then the subcommittee will decide if it is necessary for the subcommittee to hold additional hearings on this subject.

It is my hope that today's proceedings will assist us in determining the mix of old and new sea training techniques desirable for the preparation of highly competent merchant marine officers. To the extent that we are sailing in somewhat uncharted waters, I hope that the subcommittee's record will furnish a guide to the Government as well as to the industry. Through today's hearing, the subcommittee hopes to determine how it can assist the various parties to work together to solve the problem of increased sea training required by the pending convention in the most efficient and economical manner.

I want to say in the course of the hearing, at the request of the gentleman from Massachusetts, it is the subcommittee's intention to look into particular problems that have come to the fore with regard to the Massachusetts Maritime Academy and the training vessel that was taken by the academy not long ago but which ran into serious operational and safety problems. The subcommittee within the context of this hearing intends to bear down on what appears to be a very specific problem. I appreciate the gentleman from Massachusetts bringing it to the attention of the subcommittee.

Before recognizing our first witness, I think it is appropriate to take just a moment for the chairman of this ad hoc subcommittee to note the service rendered by Admiral Harrington, president of the Massachusetts Maritime Academy. Admiral Harrington appeared before this subcommittee a number of times.

Admiral Harrington, as most people in this room today know, died earlier this summer. I knew this man but a short time, yet the times I worked with him were numerous. It is my considered opinion that he was an incredibly gifted leader, one who was

deeply committed to his work, and a man who fought for what he believed in.

I admired his vigor. I admired his dedication and his unyielding tenacity in pursuing his goals, and I am certain the members of this subcommittee as well as the industry and all those who are concerned about maritime education will miss him very, very much.

Mr. STUDDS. Mr. Chairman?

Mr. AUCOIN. The gentleman is recognized.

Mr. STUDDS. May I state my appreciation for your acknowledgement of the Harrington service. I had the privilege of attending earlier this summer his last appearance at the Maritime Academy in Buzzards Bay, at which time the *Bay State* of whom we will hear more later was christened or rechristened as the *Bay State*.

I think as you suggested in your statement, hearings of this subcommittee and of any future subcommittees on this subject will inevitably be a bit less colorful because of the absence of Admiral Harrington, who had a way of stating—with that little extra energy which men of the sea have—of adding inflections and meaning to words, some of which he could never use here, to try to convey a point about which they felt strongly. I think this record should reflect, and I appreciate the chairman seeing to it that it does, that his presence was felt here and it will be for a long time to come in Massachusetts.

I thank the chairman.

Mr. AUCOIN. I thank the gentleman.

At this time I would like to call as our first witness, the witness for the U.S. Coast Guard, Rear Adm. Henry H. Bell, Chief of the Office of Merchant Marine Safety.

Admiral Bell, we would like to hear your testimony.

STATEMENTS OF REAR ADM. HENRY H. BELL, U.S. COAST GUARD, CHIEF, OFFICE OF MERCHANT MARINE SAFETY; HON. BRUCE McALLISTER, DEPUTY ASSISTANT SECRETARY FOR MARITIME AFFAIRS, MARITIME ADMINISTRATION, DEPARTMENT OF COMMERCE; AND COMMODORE WILLIAM R. HENDY, JR., ACTING PRESIDENT, MASSACHUSETTS MARITIME ACADEMY

Admiral BELL. Good morning, sir.

Mr. Chairman and members of the committee, I am Rear Adm. Henry H. Bell, Chief, Office of Merchant Marine Safety, U.S. Coast Guard. It is a pleasure for me to appear before you today to present the views of the Department of Transportation concerning sea training at the Maritime Academies and other matters relating to the provisions of the International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers, 1978. (1978 STCW).

In October 1971, the Maritime Safety Committee of the Intergovernmental Maritime Consultative Organization, IMCO, established the Subcommittee on Standards of Training and Watchkeeping. Its objective was to develop universally acceptable standards to improve training and strengthen the professional qualifications of seafarers.

The result of its work was the subject of an international conference originally scheduled for the end of 1978. The conference date was advanced to June-July of that year at the request of the United States based upon the urgency of President Carter's tank-vessel safety and pollution prevention initiatives.

The aim of the conference was to agree on a strong and effective convention, capable of early ratification by all nations so that it might come into force as early as possible. The conference, attended by 72 nations, adopted the text of the world's first international convention establishing basic standards of training, qualification, certification and watchkeeping for masters, deck and engineer officers, and certain ratings of seagoing merchant ships.

The 1978 STCW convention supports the views of the international maritime community that minimum qualifications for seafarers should be established to reduce ship-related maritime casualties with the resultant loss of life, property, and harm to the marine environment. Additionally, the mandates of the President and the Congress direct that qualification standards be reevaluated for U.S. seafarers.

For an original license as officer in charge of a navigational watch—mate—on ships of 200 gross tons or more, the 1978 STCW Convention will not impose any additional sea service requirements except for the deck cadets of the U.S. Merchant Marine Academy and five State maritime academies—California, Texas, New York, Massachusetts, and Maine.

The convention will require at least 12 months of sea service. Presently, the U.S. Merchant Marine Academy provides for approximately 9 months of sea service and the State academies provide for approximately 6 months of sea service.

The draft text of the convention before the conference did not contain a specific minimum required time of sea service for deck cadets. However, proposals were made at the conference ranging from 24 months to the original adequate period of sea service for certification of deck officers. After 2 days of discussion, a compromise of 12 months of sea service was reached. This was the minimum that could be supported by a majority of the traditional maritime nations.

The oversight report on the Federal Government's role in merchant marine officer education by the Ad Hoc Select Subcommittee on Maritime Education and Training stated that the Maritime Administration and the State maritime academies must prepare to provide a full year of sea experience—at least to deck students—when the United States becomes obligated to follow the requirements of the treaty.

The Coast Guard does not perceive that the training requirement generated by the convention will require a complete restructuring of the Federal role in maritime education and training. However, the U.S. Merchant Marine Academy and five State marine academies will have to make certain modifications to their existing programs to comply with the 12 month sea service training requirement of regulation II/4 of the convention.

In this regard, the U.S. Maritime Administration recently submitted to the Coast Guard a package proposal to meet the shortfall of sea service. This proposal offered several elements of training for

consideration under the provisions of article IX, "Equivalents," of the convention.

The Coast Guard has agreed to accept in principle the use of ship handling simulator training and the use of a small craft training program as meeting the spirit and intent of the equivalency provisions of the convention. The Coast Guard further believes that various combinations of these two training programs, properly structured, could be given credit towards satisfying part of the sea service requirements.

Obviously, an increase in sea service provided by the academies either on commercial vessels or their training ships would correspondingly reduce the need for equivalent sea service training programs.

The U.S. delegation to the IMCO Subcommittee on Standards of Training and Watchkeeping worked hard to develop increased standards for seafarers on an international level where none had existed before. Article IX, "Equivalents," of the 1978 STCW Convention will require the details of any accepted equivalency arrangements to be reported to the Secretary General of IMCO who shall circulate such particulars to all parties.

Accordingly, the Coast Guard will exercise extreme caution in the acceptance of any equivalency proposals. I feel this is the proper way to go in order to maintain our standing in the eyes of the international maritime community. In summary, our actions must be defensible.

The 1978 STCW Convention is not disruptive to our present U.S. licensing and certification system. For many years we have had a requirement that all seafarers serving on U.S. ships, in any capacity which is covered by the convention, must be in possession of a Coast Guard issued license or certificate indicating his or her qualifications.

Many of the major maritime nations—based on registered tonnage—do not have a system similar to the United States, or have no system at all. These nations will be faced with a major effort to develop and implement a workable system for the issuance and renewal of licenses and certificates to their seafarers.

As you have noted, the 1978 STCW Convention does not apply to personnel of ships operating exclusively on the Great Lakes. The Coast Guard does not intend to impose the convention standards in this area as our present system equals or exceeds the convention requirements in almost all cases.

The 1978 STCW Convention permits specialized training in certain areas in lieu of sea service. The Coast Guard intends to accept this training in lieu of sea service. This specialized training could be in a formalized education program or by use of simulators or by a mix of both. Any such training program will have to be reviewed and approved by the Coast Guard prior to its acceptance in lieu of sea service.

The Coast Guard feels that formal education, combined with sea service, is an effective method to insure the high degree of professionalism required to operate safely present day marine equipment. To this end we will encourage and assist, where possible, the continuation of effective training courses for seafarers sponsored by

the Maritime Administration, maritime labor and management interests.

Thank you, Mr. Chairman. I will be pleased to answer any questions you or members of the committee may wish to ask.

Mr. MCCOIN. Thank you, Admiral Bell.

When you refer to the mix of training, could you amplify this for the committee by outlining in some detail what steps the Coast Guard is taking, the Maritime Administration is taking and the various academies may be taking in working together to try to discuss what a proper mix of different training techniques might be, including actual at-sea training as well as simulators?

Could you tell the committee what kind of discourse has been undertaken between these parties as you attempted to develop some preliminary ideas about the mix that you refer to in your testimony?

Admiral BELL. That is kind of a tall order. We have had discussions with the Maritime Administration and the heads of the State academies at a meeting sponsored by Marad, where our commandant addressed these gentlemen, specifically stating that we do believe, as the statement said, that a properly structured program, with the use of simulators, or as the State says, small craft training programs, can be created with an equivalency to sea service time.

The academies, in cooperation with Marad, as again the statement said, had looked at this and had come forward with proposals which we have discussed and agreed to in principle.

The question outstanding, sir, is how you use the simulator in conjunction with classroom training, the syllabus that is used, how it augments the classroom experience with the practical experience for the young cadets?

Similarly, with the small-boat training or small-craft training, it is more a question of developing at each of the individual institutions their training program as they would propose, and the Coast Guard review it, to augment again classroom instruction with actual on-the-job, hands-on training aboard a ship.

In respect to simulators, we have undertaken in the Coast Guard, in conjunction with the Maritime Administration, a three-part study on the use of simulators. Maritime simulators, as you are aware, are very new, and their proponents obviously claim great things for them. But there really is little information as to their effectiveness.

We can draw on and we know of the simulators used in the aircraft industry and the nuclear industry, but we think we are facing a little different problem in the marine industry in the use of simulators.

This research program is attempting to identify the benefits as a learning experience of the use of simulators, what can be taught on them, what is the retention rate of that information, what are their strong points and their weak points, so that we can be guided in our discussions with the academies and in our own investigations and our licensing program on the use of simulators.

To sum up, sir, I think we are learning through our research program the effectiveness of maritime simulators in a quantifiable way as a teaching tool or learning experience. We have agreed

with the academies on the use of simulators and small-boat training in equivalency status to make up part of the shortfall in the sea service time.

What remains, of course, now is to look at what each individual simulator will be applied to as it integrates with their training program, and similarly with the small boats. How are they going to be used? They must augment the training, illustrate the training in an educational way, and that of course will be up to each academy to develop as part of their curriculum consistent with their other programs.

Mr. AuCoin. How long did you say the study would be? For how long will the study be conducted on simulators? When do you expect to have a report?

Admiral Bell. It has been 2 years running now and we are into phase 2. The final report is due in June 1981.

Mr. AuCoin. Is this an in-house study?

Admiral Bell. No, sir.

Mr. AuCoin. It is contracted out?

Admiral Bell. It is a contracted study. The attempt was to try to develop a little bit from the "back of the envelope" idea what simulators are, what they can do, approach it from a quantitative educational point of view so that we could understand the merits and the weaknesses of simulator training and hopefully enhance whatever simulator training was used and avoid the pitfalls that other countries have had.

Mr. AuCoin. What are some of those pitfalls, briefly?

Admiral Bell. One of the things we are discovering, to illustrate, is that a full-blown simulator—I say full blown, one that has all of the capabilities for reproducing the onboard conditions on the bridge, full color, full display, has anything everybody could ever want as a teaching tool—isn't necessary for the whole term of instruction.

We are finding that part-task simulators, as they are called, if you want to teach a man radar simulation, use of the radar for collision avoidance or piloting, you don't need this full-blown bridge simulator. You can have that as a separate element which is then integrated when he comes into the full-blown simulator. This is important because——

Mr. AuCoin. Admiral, these kinds of simulators are relatively new in this field, but you did frankly mention that simulators have been used in aviation and in other fields with success. You have a study that has been going on for at least 2 years. You are not able to tell the committee, at least today, when your own report is going to be coming in.

What is it that is so unique in the maritime field to warrant such an exhaustive study when we do see IMCO staring us in the face? We know in all probability that at some fixed point in the future we are going to have to live by its terms and need to begin to be making some fairly concrete preliminary judgments about the makeup of that mix you refer to.

We can't wait forever for that study, it would seem to me, especially with the information we have particularly in the field of aviation.

What is so mysterious about it?

Admiral BELL. There is nothing mysterious, and I hope there is no flier sitting behind me here, but most of the simulators used in aviation and the nuclear regulatory field are procedural simulators. People are taught certain procedures on them. When something goes wrong, that casualty is simulated, and then the procedure to be followed is tested out and trained on the simulator.

In other words, you are learning a series of steps via the simulator that you must take. You have flown into many airports, sir. Most airports look the same when you come into them. At least they do to me. I am sure there are wide variances, and so you are talking of a procedural approach to an airport, a procedural approach to a casualty.

With the maritime simulator, everything confronting the mariner is not procedural. Every harbor is different. Each harbor is different each time he comes in it because of the traffic confronting him, the weather, et cetera. You are using the simulators as a decisionmaking tool. You are teaching the man to make decisions when he is confronted with certain stimuli external to the vessel, or a casualty that occurs to his vessel. You are not talking procedure, although it is a learning experience. You are trying to teach decisionmaking. This is quite a bit different than procedure.

We want to make sure that when we do teach these decisions, we do it properly. Also, sir, I might say that, yes, I can't give you the end of the study, but what we have learned so far has already been integrated into both the Maritime Administration and the Coast Guard work on this subject. It is the ongoing study in phases so we don't have to wait until the very end to know the answers.

Mr. AUCOIN. What preliminary consensus is there now, knowing that this is still preliminary, about the amount of time that might be recognized on simulators to meet the at-sea training? What is your best judgment on that now, based on all the parties you have consulted and the work that you have done to date?

Admiral BELL. Properly structured, again, sir, it does depend on, No. 1, the simulator and, of course, how it is integrated into the training program. But we would perceive that up to 3 months sea-service equivalency could be credited for simulator training.

Mr. AUCOIN. The upper range might be 3 months?

Admiral BELL. Yes, sir.

Mr. AUCOIN. And also on a preliminary basis, have you given thought to what types and sizes of small craft might be allowed for such training?

Admiral BELL. We use the term "small craft" kind of loosely because normally service on a vessel of less than 1,000 gross tons is not credited.

We are not talking of rowboats. We are certainly not talking of 25-foot pleasure boats. We are talking of a boat or a ship, if you will, sir, a vessel, that is in the order of 100- to 200-foot long, this order. We have not settled on it, but it has to have some of the maneuvering characteristics that are much more similar to a large vessel than they are to a small craft. So use of the term, I think, is inappropriate.

I think, again, sir, it would depend on how the academy chooses to use it in conjunction with its training program as much as the

size of the vessel. Having eliminated the rowboat and the small motorboat, the size is important, but also how it is used.

Mr. AuCoin. Of course.

Admiral Bell. What kind of training is given on it is of equal importance.

Mr. AuCoin. Taking into account some of the varying ways it could be employed by the academies, what do you think—on a preliminary basis—might be the upper range of credit that could be given to students using small vessels?

Admiral Bell. Again, with all of the caveats I used before, we would think the upper range would be in the order of 3 months again.

Mr. AuCoin. Has the Coast Guard given thought to other training possibilities beyond those we have discussed to meet this new set of requirements?

Admiral Bell. Yes, sir; we have thought of some ourselves. We reviewed some that were put forward by the various academies jointly through Marad, and we are not convinced that there are too many other proposals that we have studied that we truthfully could go forward with and call it equivalency sea service time, and it is truthfully that we have to call it an equivalency. It is just not a question of gaining experience, but we have to go forward to the world and say that we have studied, and pretty much beyond a shadow of a doubt we have got our national reputation at stake here.

Mr. AuCoin. I think you made that point very well, and it is a view that a number of the members of this subcomittee share. We do have that reputation at stake. Bearing this in mind as well as some of these equivalency steps that could be taken, is it your feeling that there is enough of a record in the discussions on the convention to give us some guideposts—some fixed, firm, clear guideposts—which in turn would give us some assurance that these alternatives we are considering would measure up in the eyes of the other signatories to the convention, or are we just guessing?

Admiral Bell. No, sir.

In respect to the two we have talked of, the small-vessel training and the simulators, I feel very comfortable with them, from my discussions at the IMCO and at several simulator conferences I have gone to in discussions with other countries.

I am not as comfortable if we come up with some other alternatives until we have gone through the same discussion process.

Mr. AuCoin. One final question and I will yield to my colleagues.

In the debate on the convention itself, what was the U.S. position on the 1-year requirement for sea time? Did the United States push for the 1-year requirement?

Admiral Bell. No, sir; it is my understanding, but I think you have got a couple of witnesses coming up later in the day that could confirm this, we were willing to stay with—we originally went in with adequate sea service. It was some of our compatriots in the other maritime nations that started trying to get a 2-year requirement in there, and I think it was a compromise that we accepted.

Mr. AuCoin. Where is the impetus for the 2 year and the compromise for the 1 year, where did that come from?

Admiral BELL. That I can't say, sir. I did not attend it. I could find out.

Mr. AUCOIN. I am sure we can find out. I thought you might know.

Admiral BELL. Yes, sir; there are a couple of other witnesses that were in attendance that know better than I do some of the infighting that went on.

Mr. AUCOIN. Thank you, Admiral Bell.

The gentleman from Hawaii, Mr. Akaka.

Mr. AKAKA. Thank you very much, Mr. Chairman.

Admiral, there seems to be a question about demand for training, and so my question is, is there a demand for training? At one time there was a question as to whether we should even continue Kings Point. That came from a feeling that our merchant marine was declining, that we didn't need all of that personnel, and the question then was should we continue to operate these academies. And so I come back to the question: Is there a demand or increased demand for training?

Admiral BELL. Sir, I am going to have to sort of defer on that question because the Coast Guard is responsible for assuring that the training and the subsequent examination and licensing of the personnel meet the standards the United States has, but I am really not qualified to talk of the need for the training that these institutions provide.

I believe Marad can answer that much better than I could, sir, because that is their responsibility.

Mr. AKAKA. Let me ask, then, specifically about the Coast Guard.

Admiral BELL. Yes, sir.

Mr. AKAKA. This morning I came from a conference with Army Chief of Staff Myers. I guess some of his comments will be reported in the papers today.

He pointed out that they were having problems with improvement, not having enough personnel, and were seeking ways in which we could encourage young people to voluntarily join the service.

I wonder whether the Coast Guard has a similar type of problem?

Admiral BELL. Sir, speaking of the people in the Coast Guard, I think we have similar but not perhaps as aggravated problems as some of the other services. Unlike the other Armed Forces, we have been able to attract enough recruits.

The problem in the Coast Guard and in the other Armed Forces is the retention of our qualified enlisted personnel after 8 to 12 years when we have invested a lot of training money in them. These are our experienced cadre of men about which we operate. We are unable to compete financially with some of the other benefits that private industry can offer, and we are losing our people at that point.

Hopefully, the proposed pay raise this fall will do something to alleviate this. I don't think it is going to correct this situation.

Within our officer ranks we have not had the attrition that we have had in our enlisted ranks. Our retention rate in the Coast Guard in the officer ranks has been very good. It is in our enlisted personnel where the financial and the other social problems cre-

ated by living in the military have hit hardest, and it is the midgrade enlisted personnel that we are losing at a very high rate, at a great expense to the services.

Mr. AKAKA. Admiral, on page 5 of your testimony you speak about specialized training in certain areas in lieu of sea service. Can you elaborate upon that specialized training for me?

Admiral BELL. Sir, we are referring there to the general question of how much training. There is a certain requirement for sea service, and the convention recognized that training for an engineer, training in certain phases of engineering, is as beneficial when conducted in a proper classroom as it is spending a lot of time at sea learning it, and therefore when they use the words "specialized training," they are talking about training that is directed toward the rate or the license the individual holds.

For an engineer it would be, say, diesel training, maintenance, repair, et cetera. This is as opposed to just general education.

Mr. AKAKA. Thank you very much.

Mr. AUCOIN. Thank you, Mr. Akaka.

Before turning to my colleague from Massachusetts, I want to acknowledge the presence of the former chairman of the House Merchant Marine and Fisheries Committee, Ed Garmatz. It's good to see you, Ed, and we appreciate you being here today.

I want to turn at this point to the particular problem I mentioned in my opening remarks. This I think is an indication of some of the problems we find in maritime education, although I do not know of a single case that is quite as dramatic as the one the subcommittee wishes to focus on today.

The whole question of training vessels and how they are selected, how they are financed, and how viable they are is of immediate concern to this subcommittee. It is obviously a key part of the educational component of preparing our seafarers. In the case of the Massachusetts Maritime Academy, we find ourselves facing a situation in which, at a cost to the Government of $4.2 million, and a cost overrun of $700,000, a ship was received after subsequent signoffs and approvals by both Marad and the Coast Guard by the Massachusetts Academy for the training of its students.

The academy planned to schedule its training voyage on July 24, but the vessel had to come back because of repairs. In fact, it was towed back to port.

I am told, and the subcommittee staff was told that after some 100,000 man-hours of work by the students, the faculty and the administration of the academy, the ship finally was able to go out on its cruise. It will be an abbreviated 45-day cruise, but it was on September 6 that it finally was able to go out.

I don't know what this means in terms of disorder within the academy or in terms of faculty contracts and the academic schedule, not to mention the cost to the Government.

I intend to ask questions and I know the gentleman from Massachusetts who is deeply concerned about this intends to ask questions not only of the Coast Guard but also Marad. Before I ask mine I would like to recognize the gentleman from Massachusetts, Mr. Studds, who has asked the subcommittee to look into this question today. At this time I yield to him. He is recognized for such time as he may consume.

Mr. STUDDS. Mr. Chairman, I want to thank you for your willingness to focus on this among the many items of concern to your subcommitee. I never thought I would live to be a chairman or former chairman of anything. It is nice to be back.

Let me say this first. I will try very hard to keep my questions as brief as possible. This is a matter, as you indicated, of intense concern to us, and while the questions reflect on a specific vessel at one of the six academies, nevertheless I think they raise questions of general consequence and general importance to all of the academies, and in some ways I think the question of maritime training and safety in general in this country.

Admiral, I will spare you and everyone else a detailed recital. I think you are familiar with what happened to the *Bay State* in its first training cruise which lasted something less than 12 hours and which raised some very serious questions, I think, with regard to, first of all, whether or not the taxpayers money had been wisely spent.

I added some $3.5 million as you know for the Maritime Administration to take this vessel from the west coast. repair it in New Orleans, and bring it to Massachusetts this past summer. It would appear based on what we have learned so far and on accounts in the press that something less than an adequate job was done by that shipyard in New Orleans, and that a vessel set sail with over 600 people on it, most of them inexperienced sailors, which was in anything but condition to go to sea.

As I say, that raises questions with respect to the wisdom of the expenditure of taxpayers' money. It also raises in my mind questions as to whether proper safeguards are being provided for the young men and women who go on these cruises, and of course the question which will be of interest to this subcommittee is whether or not this is a unique incident affecting our own vessel in Massachusetts or whether it affects some broader problems throughout.

Let me ask you, if I may, what kind of inspections are required on a vessel like the *Geiger*, which was rechristened the *Bay State*, after it undergoes renovations as extensive as those that it presumably underwent or was to have undergone in New Orleans, and what kind of inspections were conducted on the *Bay State* at that time in New Orleans?

Admiral BELL. Mr. Studds, as you are aware, she came out of the fleet last March and she was drydocked and had her tail shaft pulled as required in San Francisco. That was part of the regulatory review. The examination is necessary. She did go to New Orleans, and she at the end of June was awarded a certificate of inspection. This is under subchapter R of our regulations which addresses school ships in particular. It is based on passenger vessel regulations, but recognizes the unique character of a schoolship.

As you note, she had a large number, 39 I believe it was, outstanding deficiencies when she sailed, of which a number, approximately 26, were required to be corrected before she took the students out on cruise.

Mr. STUDDS. You thought she was safe to sail from New Orleans to Massachusetts, but not to leave on a cruise with 600 students on it without repairing some 26 of those 39 deficiencies?

Admiral BELL. Yes, sir; some of the remaining ones were long term, such things as in the way of the refrigerators, they had not been able to inspect the shell plating, so there was an outstanding requirement. I think it was 2 years, at some time during that period to make the shell plating available. It was not a safety question. It was an inspection question.

You have another thing here, sir, that with a commercial vessel, certain things that have to be done are done obviously, and the Coast Guard really doesn't have to come in as a regulatory body to get them done. They are part of the normal machinery of maintenance. When one gets into a Government vessel or Government-financed vessel, we have different accounting than our civilian counterparts do, and in many cases the need for a repair, the parent agency or the parent unit asks the Coast Guard to document that need by way of an outstanding or an 835, as we call them. Many of these 39 outstanding items referred to were of that nature.

Mr. STUDDS. How many of them had to do with questions of safety?

Admiral BELL. I asked that question yesterday myself of my staff. They were all necessary we believe under the regulations, and they were necessary for safety. There are judgment factors. Of the 26, I would say that all had to be corrected. Some are more important than others, sir.

Mr. STUDDS. I understand.

Admiral BELL. There are certain things, if I could, sir, go on. One instance was reference to one of the mechanisms for launching one of the lifeboats. That had to be done before you took on anybody that would have to use that lifeboat. That is an illustration of one that there was no question about.

Another one was the handrails in certain areas needed repair. That is the type of thing that normally the repair would be effective without the Coast Guard having to write an outstanding deficiency on. Because of the accounting system we use in the Government, it made it easier to obtain the funds for the Coast Guard to require this rather than have an internally generated piece of paper on the ship from the academy.

So, again, you have from very serious to serious, needing correction but not of an imminent-type problem.

Mr. STUDDS. What were those you would say were the three or four most serious on that list?

Admiral BELL. Sir, I would have to provide that for the record. I can't remember all 39 outstanding ones. I remember a few of them, but I don't remember all of them.

Mr. STUDDS. I would think if there were any of major safety consequence potentially, that you would remember them, wouldn't you?

Admiral BELL. Yes, sir; but also remember that ship was allowed—the deficiencies, the 39 deficiencies—26 to be corrected before they brought the students onboard, were granted with a certificate that allowed that vessel to sail from New Orleans with a crew onboard, and therefore——

Mr. STUDDS. And she did make it?

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Admiral BELL. Yes, sir; she made it, and the people in New Orleans felt she could make it and that she was safe to proceed to sea, but with these outstanding items.

Mr. STUDDS. This may not be a fair question. This may be more a question for Marad than for you, but that long list of things, is that not precisely the kind of things you were sent to New Orleans to have done? Was that not the responsibility of the shipyard in New Orleans to effect those repairs?

Admiral BELL. I can't say, sir, because I don't know under what contract she went into New Orleans.

Mr. STUDDS. In your judgment she was at least seaworthy for the purpose of getting from New Orleans to Massachusetts?

Admiral BELL. Yes, sir.

Mr. STUDDS. When she reached Massachusetts, those additional repairs, if any of them had to be done, did the Coast Guard monitor those before she set sail or attempted to set sail?

Admiral BELL. It is my understanding, sir, that all of the 26 deficiencies that New Orleans had issued to be corrected prior to sailing were corrected.

Mr. STUDDS. They were?

Admiral BELL. Yes, sir; that is my understanding.

Mr. STUDDS. As you know, she lost all electrical power in a matter of hours after leaving port. When a vessel like that loses electrical power, does she also lose her firefighting capability and her internal communications?

Admiral BELL. The answer is a qualified no. She has onboard an emergency generator, and I believe this ship also had an emergency battery bank. It is a question not of losing the capability immediately, sir. It is a question of time. The emergency generator and the battery bank are only required by regulation to run for a certain period of time, but she is never supposed to be initially left without power.

After a certain period of time, days, yes, sir, you do run out of fuel or your batteries would run down.

Mr. STUDDS. Did the Coast Guard inspect that vessel again before she finally set out a few days ago on her cruise?

Admiral BELL. It is my understanding they did, sir.

Mr. STUDDS. Did you conclude whether or not the problems which led to the abortion of the first attempted cruise were problems that should have been corrected before? Were any of them attributable to any of the deficiencies previously noted?

Admiral BELL. I am having trouble answering the statement. It is my understanding that the cause of the first abortion of the cruise was an operational problem. It was not a problem with the onboard hardware. It was my understanding, sir, that the sea chest had become fouled with seaweed. They had lost vacuum on the main condenser, and then everything cascaded down from that. That is not a mechanical or maintenance problem. It is an operational problem that one gets involved in, and therefore it was not a deficiency that we would have——

Mr. STUDDS. What caused something like that? I mean, surely seaweed is not something one is surprised to encounter in the water. Why does something like that happen?

Admiral BELL. Normally seaweed is not a problem. It is a minor problem. In certain areas not only seaweed but shellfish or fish themselves in great number can get in and clog the salt water intakes to machinery. Normally the engineer, being skillful, aware of this, or familiar with the area, can shift to a different suction and in using water flush out his sea chest and continue on by flushing his sea chest.

It is not unusual to have circulating water problems. Normally, though, the onboard personnel recognize the problem early enough and can correct it. I can't speak specifically in this case as to what was done because I do not know. As far as their operational procedure and correcting it——

Mr. STUDDS. You are suggesting, as I understand you, that that kind of a problem is not in any way attributable to any deficiencies on the ship, but would be traced in some way to judgments made by engineers onboard at the time?

Admiral BELL. Yes, sir; based on my knowledge of what happened.

Mr. AUCOIN. Will the gentleman yield for a moment?

Mr. STUDDS. Yes.

Mr. AUCOIN. I think that the best way to proceed, and I very much commend the gentleman for his line of questioning, would be at this point to bring forward a Marad representative to the table with the Coast Guard as well as a representative from the academy to complete the questioning on this, and then those two witnesses can return later for the other set of questions.

Mr. STUDDS. The gentleman is kind and I would feel less guilty about it.

Mr. AUCOIN. You shouldn't feel guilty at all. I think the gentleman is raising very, very important questions, and I think it would be even more useful to the subcommittee to have the other two witnesses here so that you are free to ask questions of each, and so that we will have a better give and take.

I would like to bring to the table Deputy Assistant Secretary Bruce McAllister, if I may, for Marad, as well as Commodore Hendy from the Massachusetts Academy.

Will you two gentlemen come forward and sit on either side of Admiral Bell. Admiral, you are going to stay right where you are.

Thank you, gentlemen.

Mr. Studds, why don't you continue.

Mr. STUDDS. Thank you very much.

I will do my best to stay away from questions that are overly detailed. I have some general questions here.

Mr. AUCOIN. Please pursue your line of questioning. I think it is excellent.

Mr. STUDDS. May I ask, given the chairman's patience and indulgence, please feel free to respond to any questions directed to someone else, if you wish to elaborate, correct, or take issue with something that is said.

Admiral, let me just ask you a couple more questions. Was she reissued a certificate of inspection after her first unfortunate attempt to sail and prior to her eventual setting out on the cruise?

Admiral BELL. No, sir, I don't believe so. I don't believe her certificate was ever revoked.

Mr. STUDDS. It was not?

Admiral BELL. No, sir. For an operational problem such as that, unless there is a mechanical deficiency, an outstanding deficiency that needs correction, and there is some problem in correcting it, normally one would not withdraw her certificate of inspection.

Mr. STUDDS. Who has the ultimate responsibility of assuring the safety of a vessel that has undergone the process of renovation as extensive as the one in this case? Is it the Coast Guard's responsibility or Marad's or is it shared? Who is it that says, yes, this is a vessel which now in spite of its age, in spite of the extension of its alterations is prepared to set safely to sea with many hundreds of students? Is that the Coast Guard's responsibility?

Admiral BELL. It is a Coast Guard responsibility, sir, as far as compliance with whatever Federal law and regulations are concerned. The ultimate responsibility goes back as it does on all vessels to the master. The master in his professional opinion has to be satisfied as to the seaworthiness of the vessel and the preparation for the voyage.

He is concerned both with the regulatory items that we deal with, he is responsible for whatever requirements Maritime Administration has placed against the vessel, but he holds the ultimate responsibility to make sure the operational procedures and everything on that vessel in his opinion as a master, that the ship can safely sail to sea in a seaworthy condition, consistent with their voyage and the people onboard.

Mr. STUDDS. If I understand you correctly, it is the Coast Guard's contention that the major deficiencies cited when the original certificate of inspection was issued had been corrected prior to the first setting sail; is that correct?

Admiral BELL. Yes, sir.

Mr. STUDDS. And that the problem encountered at that time was one which you would characterize as operational?

Admiral BELL. That is my understanding, yes, sir.

Mr. STUDDS. Commodore Hendy, do you wish to say anything at that point?

Commodore HENDY. I kind of disagree with the Admiral that it was due to any operational deficiency on the part of our staff. I might point out that in our seaweed problem, it was mentioned that you could in some ships change to another sea suction. On this vessel there is only one sea suction. There are three turbo service generators. They have three circulating pumps, inlets and outlets, but they all are served by a common sea injection so if this one common sea injection is clogged with seaweed, you have just lost all three service generators. This is a design feature.

When this did happen they had two service turbo generators going. They shut down these two because of overheating, started the third, feeling it was free of seaweed, and parallel with what we have as another service generator except it is powered by diesel. These two generators operated in parallel, and they attempted to clean the seawed out of the other two generators.

In trying to remove the plates, they found that they couldn't relieve the pressure on the condenser. This was utlimately determined to be the result of the fact that a cross-over valve between the fire pump servicing the condenser had a hole in the valve, and

this was a valve that was supposedly inspected by the shipyard and so we had every right to believe that this valve worked.

Mr. STUDDS. Although it had not been listed as one of the deficiencies, had it?

Commodore HENDY. It was part of the specs. It was supposed to be inspected and, of course, when we finally inspected it and renewed it we found there was a hole in the belt and this is the reason we couldn't get the pressure off the condenser. It is hardly due to the fault of the operating personnel.

Mr. STUDDS. Let me clarify two things, Commodore Hendy. You said it should have been inspected. Did you mean inspected by the Coast Guard or by the shipyard in New Orleans?

Commodore HENDY. By the shipyard in New Orleans.

Mr. STUDDS. It was part of their——

Commodore HENDY. Part of the specs.

Mr. STUDDS. Part of the things they had undertaken to do under their contract?

Commodore HENDY. Yes, sir.

Mr. STUDDS. Let me make sure I understand the answer to my other question. It had not been listed in any form in connection with any of the deficiencies cited by the Coast Guard; is that correct? It was unrelated to it?

Commodore HENDY. Not until after it was discovered, of course. This was after we were back in Buzzards Bay again.

Mr. STUDDS. Let me ask you, Commodore, at that point did you have emergency power to fall back on, or were you at the risk—did you have internal communications in the ship?

Commodore HENDY. Ultimately we lost all power. The diesel generator began to overheat, and they figured this was due to seaweed in the coolers but ultimately found that the outlet valve disc had been separated from the steam and therefore it had no cooling water going through. So that generator had to be secured.

Then, of course, this caused the emergency generator to come on the line and it ran for approximately 2 hours and then it developed problems and had to be secured.

Mr. STUDDS. What was the matter with it?

Commodore HENDY. Ultimately we found that there was quite a bit of work had to be done in the pistons and rings and cylinders.

Mr. STUDDS. The emergency generator was not in good operating condition either.

Commodore HENDY. Not after 2 hours. Up to that time it had been run for small periods of time, and everyone I suppose had every reason to believe that it was in operational status. But after a 2-hour test in this emergency situation it proved that it wasn't up to the standards that it probably should have been.

Mr. STUDDS. And when it failed, you lost internal communication?

Commodore HENDY. Well, we had emergency power through batteries in which we had communications ashore.

Mr. STUDDS. How about firefighting capability?

Commodore HENDY. During the brief period of time in which we secured the fire pumps to try to determine where the pressure, was and tried to relieve the pressure on the condensers so we could

clean the condensers, during that period of time we also had available a diesel fire pump in the forward end of the ship.

Mr. STUDDS. Do I understand you correctly to say that in the event that the valve in question had been operating as it ought to be, that you would not have had or that you could have dealt satisfactorily with the problem?

Commodore HENDY. Certainly we would have been able to get in the condensers and remove the seaweed that was there, and perhaps this may have made it possible for us to get operational again. It was a sequence of events that I wouldn't wish on anyone.

Ultimately, when the emergency generator stopped, they had been working on the diesel-powered service generator and were about to put it back on the line. And when they attempted to do so at that time, the air, starting air had been dissipated and so they were unable to start the diesel. They then made another attempt to start one of the turbo service generators with what steam was left in the boilers, and we were unable to start that because they couldn't get the vacuum desired, the starting 5 inches of vacuum, and it dropped immediately to a pressure situation where a valve automatically closed the steam valve on this vessel.

Mr. STUDDS. Let me ask you a more general question. I have read many, many press reports purporting to detail the nature of the deficiencies that you found when that vessel arrived in Buzzards Bay.

Can you just characterize generally for us the condition of the vessel? I suppose rather than going through 39 specific detailed deficiencies, what shape was she in?

Was she ready to go to sea for her purposes? How did you receive her? What did you find when you took a look at her?

Commodore HENDY. When the vessel arrived in Buzzards Bay we had to assume it just completed a 2,000-mile journey and had to be in some reasonably good shape. We assumed that it had been approved by the Coast Guard to sail, which it had.

The vessel arrived on July 8, and 2 or 3 days later we received a letter from its New Orleans Office of the Coast Guard dated July 11 in which the deficiency list that you cited, 39 deficiencies, with 26 items to be completed before we left Buzzards Bay, this was received by the academy after the vessel arrived in Buzzards Bay.

Mr. STUDDS. Obviously, you fixed all 26 items before she set sail?

Commodore HENDY. Yes.

Mr. STUDDS. At what cost?

Commodore HENDY. I don't believe I could supply a cost figure at this time, because the Maritime Administration is in a better position to do that. At that time I think the cost to the Commonwealth was minimal.

Mr. STUDDS. Let me ask, and perhaps Mr. McAllister is the one to ask this, should not all of this work have been done in New Orleans? Is this not why a ship is sent to be renovated, to get her ready for sea and not to get her with a list of 39 things that says she isn't ready for sea?

Mr. MCALLISTER. Subject to elaboration or correction by some people who are here, including Art Friedberg and John Davis, who is the Chief of our Division of Ship Management, it is my under-

standing on reviewing this incident that there were serious time and budgetary constraints on all of the people involved.

I don't mean that as an excuse but simply as part of the environment.

If I may answer you perhaps more fully, I will try and get to a direct answer to your question. As you know, the Maritime Administration is charged with reactivating vessels out of the national defense reserve fleet and out of the Ready Reserve Fleet, and we do that every year, the Maritime Administration does, in coordination with the Coast Guard and other agencies.

For instance, there is a vessel called the *Washington*, which was pulled out of the national defense reserve fleet, activated at a cost of something around $3 million, and is now serving in, I believe, a NATO exercise. Two vessels have been pulled out on less than 10 days notice, and were activated satisfactorily to the military.

This is not an easy job. The cost in excess of $4 million that was spent in drydock and in New Orleans for topside work is not unusual when you pull an inactive vessel out and try and reactivate her.

Mr. AuCoin. Mr. McAllister, why don't you respond directly to the question?

Mr. McAllister. I cannot answer that, however, with a yes or a no. We would certainly wish that all of the deficiencies were completely taken care of. I believe that the admiral is correct when he said that the reason for the stoppage of this particular first voyage was not causally connected to any of the deficiencies that we knew about.

I simply wanted to emphasize, and I will end my answer here, the effort by all the parties involved, including the Massachusetts Maritime Academy, to discover all of the deficiencies that might have existed in this vessel.

I think they all extended themselves and tried as hard as they could to find them all.

Mr. Studds. What process is used to select contractors for this kind of renovation work?

Mr. McAllister. In this case it was a combination, primarily a bid, competitive bid, and then negotiated after that.

Mr. Studds. How closely does Marad monitor the actual renovation work? Do you have onsite inspectors or do you come and look at it after it is all done or what do you do?

Mr. McAllister. Yes, sir. For instance, on the delivery voyage, and prior to that time, the Maritime Administration had representatives aboard. We hired an independent surveyor also to attend in order to get an independent judgment.

Mr. Studds. Are you speaking about during the work or during the voyage?

Mr. McAllister. I am speaking about during the work, but also during the delivery voyage from New Orleans to Buzzards Bay, and during the delivery voyage, the master, the chief engineer, the first mate and the chief mate who were going to sail the vessel were on board during that voyage.

The Coast Guard, the American Bureau of Shipping, all had representatives during the work, at delivery, to try and test the

vessel as completely as could be tested in the timespan that was allowed.

Mr. STUDDS. Was Marad aware of the nature and extent and magnitude of the deficiencies in the work?

Mr. MCALLISTER. Yes, sir.

Mr. STUDDS. Were they reported to the Coast Guard or to the academy, or why did Marad let her go? Do you think your contract was fulfilled with that shipyard?

Mr. MCALLISTER. I would have to ask, because I am not familiar with the exact terms of the contract. If you will allow me a moment, I will get an answer.

Mr. STUDDS. Certainly. You may have that moment.

Mr. MCALLISTER. The contract wasn't set up, as I understand it, and this is fairly typical in this industry, with a set of specifically detailed specifications or jobs that were to be done at first, and then the shipyard simply fulfills them.

As is normal in cases like this, pieces of equipment are opened up. As the inspection goes on particular jobs are put in hand. As Mr. Davis, whom I mentioned to you before, just related to me, everything that was put in hand for that shipyard to do was done satisfactorily in the opinion of the people who were involved in inspecting the work and judging the work.

Mr. AUCOIN. Mr. McAllister, if the gentleman from Massachusetts will let me interrupt for a second, who does the initial inspection? If I understood you correctly, you said the ship is opened up, the inspection is done and then the work is performed on those items which the inspection revealed needed work.

Who performs that first inspection? That is not the Coast Guard?

Mr. MCALLISTER. Well, certainly the Coast Guard has requirements. They tell you what to open up, what needs to be inspected, at least.

Mr. AUCOIN. Is it the Coast Guard, then, that provides what then becomes the working list of repairs?

Mr. MCALLISTER. I would say that is part of the working list.

Mr. AUCOIN. What else goes into it?

Mr. MCALLISTER. American Bureau of Shipping, and this is overlapping, and then what additional inspections lead you to.

Mr. AUCOIN. Who does the inspecting?

Mr. MCALLISTER. In this case I will have to ask Mr. Davis again. I am not sure which agency or whatever took the lead.

Mr. AUCOIN. Mr. Davis, would you identify yourself for the record?

STATEMENT OF JOHN DAVIS, CHIEF, DIVISION OF SHIP MANAGEMENT, MARITIME ADMINISTRATION

Mr. DAVIS. I am John Davis, with the Maritime Administration, Chief of the Division of Ship Management. The ship, when it was pulled out of the fleet, had at that time a specification developed for repair work based on our best knowledge. It was based on a survey report that was done on the ship when it was laid up, which noted certain deficiencies.

Mr. AUCOIN. Who did that survey?

Mr. DAVIS. I believe it was the Navy, MSC. The ship was operated by MSC at that time. We used their records to develop certain

repair work, and we also developed items based on what the U.S. Coast Guard and the American Bureau of Shipping would want done, before the ship could be classed and certified by the Coast Guard.

Mr. AuCoin. How old was that survey?

Mr. Davis. The survey was probably about 13 or 14 years old.

Mr. AuCoin. That became the working document?

Mr. Davis. That became the working list, and we knew that there would be additional items. Normally when you activate a ship you can anticipate another 30 percent.

Mr. AuCoin. If the gentleman will just let me have an additional moment here. What do you do to survey the vessel further to find out what other things in the course of 14 years may have gone wrong with it?

Mr Davis. We have to have something to start with, to put the bids out.

Mr. AuCoin. I can understand what you are starting with.

Mr. Davis. Once the ship goes into a shipyard, then you do a lot of opening and inspecting.

Mr. AuCoin. Who does that?

Mr. Davis. We put that work in hand.

Mr. AuCoin. You do that?

Mr. Davis. Yes.

Mr. AuCoin. You are responsible for that?

Mr. Davis. We are responsible to check out the items when the work is put in hand to inspect them, as well as like the Coast Guard is responsible to inspect——

Mr. AuCoin. So the faulty equipment that was identified a moment ago was missed by that inspection that you performed?

Mr. Davis. What faulty equipment are you specifically talking about?

Mr. AuCoin. The valve.

Mr. Studds. The 39 deficiencies, not counting the valve.

Mr. AuCoin. Commodore Hendy indicated there was a valve with a hole in it.

Commodore Hendy. Crossover valve.

Mr. AuCoin. That seemed to be the linchpin of the whole unhappy scenario. That was not identified in the course of your additional survey; is that what you are saying?

Mr. Davis. I can't say if that specific valve was opened up and inspected or not. We would have to look at the specifications before I could answer that, to say if that is correct.

Mr. AuCoin. Do you think one of the problems is that you basically take a survey that is in almost every instance of this kind by definition several years out of date and accept it as the working document to guide whatever renovation or repairs are necessary? Is that the problem?

Mr. Davis. The only way you can identify what actually has to be done is wait until the ship goes to a repair yard and you start opening up machinery and inspecting it and testing it. A ship that has been laid up that long, there is no other way to do it. You have to wait until it is in a shipyard.

Mr. AuCoin. The gentleman from Massachusetts.

Mr. STUDDS. Let me just for the record give you some idea. I think in the time I have remaining for a moment switch to a more general level of questions. I am reading from a story in the Cape Cod Times on this incident, and it says after the ship lost power on her first attempt to sail:

> In a report filed after the breakdown, Coast Guard Inspector Carl W. Beale wrote that the *Bay State* had lost fire-fighting capability when the generators broke down. He also wrote that, "The fire detecting system and possibly the smoke detecting system were inoperable."
>
> The repairs made by the academy after the Bay State returned to Taylor's Point are almost too numerous to list.

In terms of Marad thinking about the adequacy of its system:

> A partial list of items repaired, according to Lyons and engineer Bradley Lims, would include:
>
> About 200 large valves, and numerous smaller ones.
> Five generators.
> Two boilers.
> Evaporators, which produce fresh water from motors.
> Air compressors.
> About 100 electric motors.
> Electric switches.
> Pumps.
> Refrigeration systems.
> Fans.
> Boiler controls.
> Transformers.
> Pipes.
> Sanitation systems.

It would seem to me that if that list is even remotely correct, and no one has suggested that it is not, the adequacy of the entire system of inspection by Marad and possibly the Coast Guard ought to be one of the most serious of questions.

A vessel with that laundry list of major repairs to be made, doesn't that make you wonder what it is your inspectors are reporting to you about?

Mr. DAVIS. When the vessel was put in the shipyard for repairs, there were over 400 items that were put in hand, and we sailed the vessel from New Orleans to Buzzards Bay successfully, and then we put the additional items in hand, the 26 items that the Coast Guard had required.

In addition, we put several more items in hand when the vessel got there. There were other items that were identified by the chief engineer, the master of the vessel, and by Marad people.

We sat down with Massachusetts maritime, went over the list, identified which ones we were to put in hand at that time, so that the cruise could commence. We considered the vessel operationally ready to sail.

Mr. STUDDS. I don't want to be unfair in any way to Marad or anyone else. Let me again say if anybody wants to respond, I am going to drop the specific level of questions, but I think anyone would have to agree that some awful serious questions are raised when you have a vessel in this condition. For example, it appears that she was dumping raw sewage at her mooring in the Cape Cod canal because there was no sewage system in the vessel. Is that right?

Mr. DAVIS. The Coast Guard gave us a waiver on that sewage treatment plant, so that the academy could conduct its 1980 cruise.

Mr. STUDDS. Right; but I would have thought that a sewage treatment plant would be a fairly standard item on a vessel these days of that size, would it not?

Mr. DAVIS. We were limited as far as money is concerned.

Mr. STUDDS. I think this is where we get into questions of concern to everybody. The whole question of at-sea training for the students in the academies here, the chairman will recall that the subcommittee in previous Congresses has raised this question.

You have elaborated on it and gone into it in greater depth. First, the question of whether we should try to place these cadets in berths on ongoing commercial vessels or whether we should try to get sufficient capability in ships for each of the academies. We have been round, and round, and round and we concluded that we could not afford to construct new vessels for each of the State academies and, consequently, the hunt was on and has been on to locate older replacement vessels that could be used.

I remember I believe over a matter of some time, perhaps a year or two, asking the Maritime Administration whether there was anywhere in the mothball fleet in this country something to replace the previous State training vessels of the Massachusetts academy.

As I recall, and I can't give you months and precise dates, but as I recall, for a substantial period of time we were told effectively that nowhere in the mothball fleet capability of the United States can a vessel be found that has approximately the right characteristics for a training vessel of this kind.

Then we thought we found a couple, it turned out, as I recall, that Spain wanted. Consequently, they received the two vessels that the Massachusetts academy wanted. I wonder if someone in the Maritime Administration could tell us a little bit about the process by which we conduct a survey presumably of the existing vessels that might be available for the State academies for these purposes and how it was in particular that this vessel happened to be chosen for the Massachusetts academy, and what were the alternatives, if any.

Mr. MCALLISTER. I believe I can provide at least part of the answer to that, and if I may, I will be reading from a report given to me last week.

Admiral Harrington, the president of the Massachusetts Maritime Academy, wrote a letter October 10, 1978, asking that the then *Bay State* be replaced. In his letter the Admiral stated that a "* * * thorough search had been made for potential training ship replacements. As part of this search Marad had made arrangements for academy personnel to visit the San Francisco area, to inspect several vessels there."

Admiral Harrington concluded in that letter "* * * that the most viable school ship replacement candidate was the U.S.N.S. *Geiger*," the present *Bay State*.

In early 1979 or late 1978, some Massachusetts maritime alumni learned that the U.S.S. *Francis Marion* was to be retired by the Navy. They also then learned that the U.S.S. *Paul Revere*, a sister ship of the *Marion*, was also scheduled for retirement.

Those are the two vessels which were ultimately near the end of June of that year transferred to Spain.

At that point in 1979, attention was reluctantly turned back to the *Geiger*, and Marad assembled a list of other possibilities of which the U.S.S. *Tulare* was considered the most promising. That was a vessel which was not in mothballs.

A group of Massachusetts maritime and Marad representatives visited the *Tulare* in San Francisco in August 1979. The conclusion of the visiting group was that a major conversion would be required to make the *Tulare* suitable. The cost of such an undertaking was estimated to be about $6 or $8 million, and was deemed to be prohibitive.

At the request of the academy, arrangements were made for academy personnel once again to visit the *Geiger*, to identify their specific needs for its use as a training vessel.

In October 1979, Admiral Harrington, in a telegram to Assistant Secretary Nemirow, once again formally requested the Maritime Administration to activate and prepare for school ship service the U.S.M.S. *Geiger*.

Mr. STUDDS. I think that is because the *Bay State*, too, at that time was sinking, not literally, but he needed a ship very badly.

Mr. MCALLISTER. That is correct.

Mr. STUDDS. The former *Bay State*, correct me, was the former *Empire State*. It was a former hand-me-down, was it not?

Commodore HENDY. That is correct.

Mr. STUDDS. Do I understand you, Mr. McAllister, that you, in cooperation with officials of the academy, surveyed existing possibilities exhaustively, and discovered the U.S. *Geiger* was the best this country had to offer as a training vessel to one of our State maritime academies?

Mr. MCALLISTER. At this point, under the policies of using national defense reserve fleet vessels, that was the best that anyone could come up with.

Mr. STUDDS. Mr. Hendy, do you want to add anything to that?

Commodore HENDY. Not that, but if I could at this point, I know that we have been asking the Maritime Administration and the Coast Guard some very pointed questions. As you know, I am acting president inasmuch as the Admiral died on July 25. Since that point in time, I have been more actively engaged in the training ship and its problems.

I would like to say that since the vessel has been in Buzzards Bay that the Maritime Administration has been aboard the vessel since Buzzards Bay, and I believe it is still aboard the vessel, and I have received the ultimate in cooperation.

They have given me everything I have asked for. I have talked to Mr. Nemirow and I have talked to the various people below him, and this is true all the way down through the chain.

I would also like to say that the Coast Guard certainly has done its job in Buzzards Bay, even though we look with disdain, the fine tooth comb that they seem to bring aboard, it seems to get finer each day and we seem to pick up more and more items, nonetheless, I personally wasn't too excited about it because I knew in the end that when we finally cleared that list that the vessel certainly would be ready for sea. And so I must say that the Coast Guard did an excellent job in identifying and giving us those 835, so I have

praised, at least in the Buzzards Bay administration, the Maritime Administration and the Coast Guard for what they did.

Mr. STUDDS. We have a diplomat, as you can see, acting in the post. It is all right, now? The radio is working.

If I may, I want to thank all three gentlemen at the table and the chairman for his forbearance. I think, and I may be speaking prematurely because I have not had an opportunity to look at all the details that I should before reaching such a conclusion, but it appears to me the villain in this, if there is a villain other than the Coast Guard or the Maritime Administration, is the broad policy questions facing this subcommittee and this country with respect to the adequacy of our capability to train young men and women for the merchant marine. I think it is a question with which this subcommittee will have to wrestle. But this incident may indeed be a paradigm, if you will, an awfully good illustration of why we have a problem. If a country with resources as vast as our own can indeed do no better than to offer to its institutions for the training of merchant officers at sea, a vessel in the very sorry state and ancient age of the *Geiger*, then I think the lessons we will learn will transcend the lessons of the students at the Massachusetts Academy that have been affected because of this. Although it will not be of much comfort to those whose lives were interrupted, something will be effected.

I wish the chairman well in his responsibility in this matter, not only in behalf of this particular academy, but in all maritime institutions in the country in what is a very, very serious deficiency, it seems to me, in our capacity to train men and women in matters of national defense.

I thank the chairman very much for his patience.

Mr. AUCOIN. I want to tell the gentleman from Massachusetts that the subcommittee does plan to look more closely into this particular incident to see what we can find in addition to today's proceedings. Obviously, in a short period of time, there is not nearly enough time to investigate entirely all matters that would be instructive to us.

Mr. STUDDS. I trust the chairman will be at Buzzards Bay when the vessel returns. In fact, if he comes to Castine, Maine, the gentleman from Maine will see it on his way home.

Mr. AUCOIN. An important point has been made, and if it is true, as the testimony today brought out, that the *Geiger* was the very best that could be offered to the academy, that says quite a bit about the matter. I think the gentleman's conscientious effort to bring this to the committee's attention even though we proceeded somewhat out of order to obtain this testimony.

I would ask each of the men at the table if they would in 25 words or less indicate to the subcommittee what they think has been learned from this experience from their own vantage points in terms of any corrections or improvements that ought to be made.

Admiral Bell, have you any observations?

Admiral BELL. I was hoping I could go last.

No, sir; I do not have any sage words that I can arrive at as a result of this. I think it is illustrative of the problems, as you yourself referred to and Congressman Studds, when one does take

an old ship that has been inoperative for a long time, one is to expect that a host of things will go wrong. A ship is a complex piece of machinery. Normally during its operating life, you have people on board watching, cognizant of what is going on. So when they go in for repair, you have knowledge of them and there are no surprises, or the surprises are limited. Here you took something out after an extended inactive period. I would submit you are going to have problems with any ship that has been laid up a long time.

Mr. AuCoin. Does this raise questions in your own mind about the Coast Guard's inspection procedures, and have you formulated something in your own mind as to changes in the future?

Admiral Bell. Our critics are on both sides, one feels the Federal Government should come in to do all this investigation, and the other feels we should be there to verify the shipyard has done those things. The Federal Government is not intended to take the place of the management of the company in developing the work list, assuring that it is done, paying for it, all the other good things. We verify that things are done, but still the sound operation of a vessel is the responsibility of management.

Mr. AuCoin. You do not foresee any changes in your inspection procedure?

Admiral Bell. No, sir; no changes.

Mr. AuCoin. Mr. McAllister.

Mr. McAllister. I agree with Admiral Bell. I do not pretend every action by every person in Marad was perfect. By the way, Marad will of course cooperate to the fullest in any continuing investigation the chairman wishes to make.

I want to go through the simple business problem of transferring one vessel from one operation to another. Even a relatively small vessel, when transferred from one company to another, runs into serious problems, because the people who have been operating it are not the people who wind up operating it under the new owner, and you find numbers of things unknown to the second set of people. That is magnified 100 times in the case of the *Bay State*. It is practical problems like that that simply cannot be met by efficient and hard-working people doing the best they can.

Mr. AuCoin. You will basically maintain current procedures?

Mr. McAllister. Yes.

Mr. AuCoin. Commodore Hendy.

Commodore Hendy. The Massachusetts Maritime Academy has learned a lesson, the importance of the training ship and its importance to the life of our academy. We have found out our sister academies are closely tied to us, in that they cooperated with us in getting the vessel underway, without which we would not be at sea today.

Mr. AuCoin. From your vantage point, do you think this subcommittee should encourage either of the two agencies to review their inspection procedures? That is the question I am asking of this ad hoc panel.

Commodore Hendy. I would like to avoid that question and go to finances.

Mr. AuCoin. Invoke the spirit of Harrington and give me an answer to the question.

Commodore Hendy. I feel the operating——

Mr. AUCOIN. Is there a problem with the inspection process used by these two agencies that this committee needs to look into?

Commodore HENDY. I think the inspection process is probably all right, Mr. Chairman, but I think the process could be improved if we could receive substantial commitments in funds in reactivating these vessels.

Mr. AUCOIN. Admiral Bell, one final question for you. The other two gentlemen are dismissed.

Staff has handed me, Admiral, a transcript of a previous hearing in which Secretary Nemirow indicated that the Coast Guard had given Marad tentative authority to accept simulator time for at least 3 or 4 months for the 12-month seatime requirement. This seems to me slightly at variance with the testimony you gave today, in which you said perhaps an outer limit of 3 months could be reached. Is there a conflict here?

Admiral BELL. Obviously there are different numbers appearing there. He used the word tentative approval. We said we approved in principle. I think the bottom line is, one has to look at the simulator in use, the training instructions, just what they do with it.

Mr. AUCOIN. We know that, but Marad seemed to have the impression at the time of the February authorization hearing that had tentative approval for at least 3 to 4 months. Has there been a change in your thinking since then, or was Marad mixed up?

Admiral BELL. I am going to get in trouble either way. I cannot say Marad was mixed up. Since February of this year we have been in negotiation, but had received no definitive proposals. We had discussed them, the use of simulators, but we had not studied it in depth. It was at that time that the Maritime Administration in conjunction with Kings Point put forth this package. We replied to it sometime late this spring—July 31—that is pretty late spring. That is when we talked of the 3 months. So to go back to the question of 3 or 4 months, I think that was during the preliminary stages, and I think we are still in the preliminary stages, but I would not want to wrestle anybody over 3 or 4 months at this period in time with the little knowledge we have of the simulators or the training programs, sir.

Mr. AUCOIN. Thank you, Admiral.

Mr. Emery.

Mr. EMERY. I have no questions.

Mr. AUCOIN. Admiral Bell, we thank you for your testimony.

I would like to call back to the witness table Deputy Secretary McAllister. He is accompanied by Arthur Friedberg, Director of the Office of Maritime Labor and Training, and Capt. Paul Krinsky, USMS, Academic Dean, U.S. Merchant Marine Academy.

STATEMENT OF HON. BRUCE McALLISTER, DEPUTY ASSISTANT SECRETARY FOR MARITIME AFFAIRS, ACCOMPANIED BY ARTHUR FRIEDBERG, DIRECTOR, OFFICE OF MARITIME LABOR AND TRAINING, AND CAPT. PAUL KRINSKY, USMS, ACADEMIC DEAN, U.S. MERCHANT MARINE ACADEMY

Mr. MCALLISTER. As the chairman has noted, with me are Capt. Paul L. Krinsky, Dean of the U.S. Merchant Marine Academy, and

Mr. Arthur Friedberg, Director of the Office of Maritime Labor and Training of the Maritime Administration.

Captain Krinsky has a prepared statement he will summarize. And Mr. Friedberg is available to respond to whatever questions the subcommittee may have.

Attempting to summarize this prepared statement, Mr. Chairman, the Admiral carefully summarized, I believe, the events leading up to the adoption of the convention in July 1978, and I believe he also summarized accurately the primary impact of that convention on maritime training in the United States, and has focused on the increased seatime requirement to 1 year. That is the point that I will attempt to summarize here.

As you gentlemen know, the Maritime Administration operates the U.S. Merchant Marine Academy at Kings Point, and we provide assistance to six maritime academies.

To increase the Kings Point system or 6-month State school system at this point we believe would be not only very troublesome with respect to budgetary constraints, but would also raise havoc with the academic programs currently being offered at those schools. It is my personal belief also that the add-on of at-sea training would not be as valuable as the equivalent training that we have proposed to the Coast Guard and which we are continuing to refine, namely, training with small craft and training with simulators.

I think I can leave the summary there, with just a short conclusion, and that is that I believe simulators to be a very large step forward in training, and we should go to simulators even without the impetus or thrust of the IMCO convention behind us.

I think this is a new generation of maritime training that we would be well advised to take advantage of, even without the increase proposed by the convention.

I would be happy to respond to questions.

[The statement of Bruce A. McAllister follows:]

PREPARED STATEMENT OF BRUCE A. MCALLISTER, DEPUTY ASSISTANT SECRETARY FOR MARITIME AFFAIRS ON BEHALF OF THE MARITIME ADMINISTRATION, DEPARTMENT OF COMMERCE

Mr. Chairman and Members of the Subcommittee, I am Bruce A. McAllister, Deputy Assistant Secretary for Maritime Affairs of the Department of Commerce. I am standing in for the Assistant Secretary for Maritime Affairs who has requested that I convey to you his regrets at not being able to appear before the Subcommittee this morning.

Mr. Chairman, I am accompanied by Captain Paul L. Krinsky, Dean of the United States Merchant Marine Academy, and by Mr. Arthur Friedberg, Director of the Office of Maritime Labor and Training of the Maritime Administration. Captain Krinsky also has a prepared statement, and we will be pleased to proceed in any way you wish. As you know I am relatively new at the Maritime Administration, and Mr. Friedberg is available to respond to technical questions that the Subcommittee may have.

It is a pleasure to be here this morning. I appreciate the opportunity to comment on the sea training requirements of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, hereafter referred to as the Convention, as they affect the maritime education and training responsibilities of the Maritime Administration.

I might say at the outset, Mr. Chairman, that these hearings are most timely and naturally follow the work of you and your Subcommittee with respect to the Maritime Education and Training Act of 1980.

The text of the Convention was adopted on July 7, 1978 by a conference of representatives of 72 nations convened in London at the invitation of the Inter-

Governmental Maritime Consultative Organization. The Convention was signed on behalf of the United States, subject to ratification, on January 25, 1979. It will enter into force 12 months after the date on which not less than 25 countries, the combined merchant fleets of which constitute not less than 50 percent of the gross tonnage of the world's merchant shipping of ships of 100 gross register tons or more, have become parties to it. So far, the Convention has been ratified by the Soviet Union, France and the German Democratic Republic. We estimate that it may take anywhere from five to six years for the Convention to come into force.

On August 10, 1979, President Carter transmitted the Convention to the Senate for advice and consent to ratification. It is currently under consideration by the Senate Foreign Relations Committee.

As set forth in the President's letter, "This Convention establishes improved and often new international requirements for training, certification and watchkeeping for masters, officers and certain crew members of "seagoing" merchant ships. These requirements should provide more highly qualified personnel on board ships and thereby reduce maritime casualties and promote safety of life at sea and protection of the marine environment. Such international requirements are responsive to proposals which were made by the United States in March 1977, following a series of tanker accidents in or near United States waters."

The agencies of the United States government primarily responsible for the subjects addressed by the Convention are the United States Coast Guard and the Maritime Administration.

As you know, the Maritime Administration operates the U.S. Merchant Marine Academy at Kings Point, New York. We also provide Federal assistance under the Maritime Academy Act of 1958 to the six State Maritime Academies located in Maine, Massachussets, New York, Texas, California, and Michigan. All these schools train students to be deck or engineering officers in the U.S.-flag merchant marine. Therefore, the provisions of the Convention are of great interest to the Maritime Administration.

IMPACT OF THE 12-MONTH SEATIME REQUIREMENT

Mr. Chairman, while we consider the Convention to be a major first step in establishing minimum international standards for the professional competence of merchant marine personnel of all flags, we do have difficulty with some of its provisions.

Regulation II/4 of the Convention sets forth the at-sea training requirements for licensed deck officers and Regulation III/4 sets forth such requirements for licensed engineering officers.

We do not anticipate that Regulation III/4 of the Convention will be a problem with respect to the training of engineering officers at the U.S. Merchant Marine Academy or the State Maritime Academies. It provides that every engineering officer in charge of a watch in a traditionally manned engine room or the designated duty engineering officer in a periodically unmanned engine room on a sea-going ship powered by main propulsion machinery of 750 kw, equivalent to 1,000 SHP, or more shall have completed *an adequate period* (emphasis added) of sea going service which may have been included within the prescribed three year period of approved education or training. There is no reason to believe that the current curriculum for marine engineering students at the U.S. Merchant Marine Academy and the six State Maritime Academies will not be adequate to accommodate this requirement of the Convention.

With respect to the training of deck officers, Regulation II/4 of the Convention is of particular concern to us. That Regulation requires that every candidate for certification as a deck officer on a sea-going ship of 200 gross register tons or more shall have "approved sea-going service in the deck department of not less than three years which shall include at least six months of bridge watchkeeping duties under the supervision of a qualified officer; however, an Administration (Nation) may allow the substitution of a period of special training for not more than two years of this approved sea-going service, provided the Administration (Nation) is satisfied that such training is at least equivalent in value to the period of sea-going service it replaces." In brief, Regulation II/4 requires a minimum of one year of approved at-sea training for licensed deck officers.

This provision of the Convention would affect the training programs for deck officer candidates at the U.S. Merchant Marine Academy and at five of the six State Maritime Academies. The Great Lakes Maritime Academy, located in Michigan, trains deck cadets for service as pilots on the Great Lakes; service that will not be covered by the Convention. The U.S. Merchant Marine Academy and the State Maritime Academies located in Maine, Massachusetts, New York, Texas and Cali-

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fornia generally train deck cadets for deep-sea service as a licensed deck officer; service that will be covered by the Convention.

At the present time, the U.S. Merchant Marine Academy strives to provide ten months at-sea training on commercial vessels, and the five State Maritime Academies provide six months at-sea training on federally-owned Training Ships. Clearly, the at-sea training provided deck cadets at all these schools would have to be adjusted in order to comply with a literal reading of the requirements of Regulation II/4 of the Convention.

However, Article IX of the Convention, entitled "Equivalents," provides that "The Convention shall not prevent an Administration from retaining or adopting other educational and training arrangements including those involving sea-going service and shipboard organization especially adapted to technical developments and to special types of ships and trades, provided that the level of sea-going service, knowledge and efficiency as regards navigational and technical handling of ship and cargo ensures a degree of safety at sea and has a preventive effect as regards pollution at least equivalent to the requirements of the Convention. Details of such arrangements shall be reported as early as practicable to the Secretary-General who shall circulate such particulars to all Parties."

ALTERNATIVES FOR COMPLYING WITH REGULATION II/4

The Maritime Administration has given careful consideration as to how best to accommodate the requirements of Regulation II/4 and Article IX of the Convention with the at-sea training now afforded students at the United States Merchant Marine Academy and the State Maritime Academies.

1. U.S. Merchant Marine Academy

The requirements of Regulation II/4 and Article IX will present a problem with respect to our operation of the United States Merchant Marine Academy. At the present time we are striving to provide students at the Academy with ten months sea time on commercial vessels. For prospective licensed deck officers, we hope to supplement this training with additional training on bridge simulators and on small craft at the U.S. Merchant Marine Academy. Captain Krinsky will comment further on this when he presents his prepared statement.

2. State maritime academies

The five deep-sea State Maritime Academies would appear to have a more serious problem with the requirements of the Convention, as they currently provide only six months at-sea training on their Training Ships. We are currently reviewing the options for providing the increased sea training for deck officers required by Regulation II/4, or its equivalent as provided by Article IX.

(a) *Extended use of Training Ships.*—The most obvious option would be to require the State Maritime Academies to provide more than the current six months of sea time training on their Training Ships. This option would be expensive to both the States and the Federal Government, and would be disruptive to the academic schedules at the State Maritime Academies. These schools are barely able to meet their operating costs now, and plainly could not afford to operate the Training Ships to satisfy the Convention's 12-month sea time requirement. The Academies would each face an operating cost increase ranging from $500,000 to $800,000 per year at today's costs, including $200,000 for fuel costs.

Our rough estimate of the impact on maintenance costs of doubling the operating time for the Training Ships, is that these Federal costs could increase by as much as 50 percent. Additionally, this option would be disruptive to the academic schedules of the State Maritime Academies both ashore and at sea. Maine Maritime Academy has already indicated to the Subcommittee that it would be virtually impossible to maintain and operate a Training Ship and include this extra time within the four-year program. These Training Ships are generally operated by deck and engineering students under the supervision of licensed officers. Therefore, any extension of sea training to provide for deck students under Regulation II/4 of the Convention would subject the engineering students to unrequired sea time. Also, the shoreside academic schedule of these schools is closely tailored to the annual two month cruises of the Training Ships.

(b) *Use of Commercial Vessels.*—Another option would be the use of U.S.-flag commercial vessels to provide the additional sea time for deck students required by Regulation II/4. However, it is unlikely at the present time that sufficient berths could be made available for this purpose. Captain Krinsky, in his statement, discusses further some of the difficulties inherent in the use of commercial vessels.

(c) *Training on Small Craft.*—The fundamentals of seamanship and shiphandling can be acquired by training on small craft. Such training could be made a part of

the program at the State Maritime Academies. Some of the Academies already provide such training, and others are contemplating acquiring small craft for this purpose. The Maritime Administration believes that training on small craft at the State Maritime Academies appears to be a viable option for providing part of the increased sea time required of deck students by Regulation II/4. In this regard, at the 12th Session of the IMCO Subcommittee on Standards of Training and Watchkeeping, held from July 9–13, 1979, a film was presented on a proposed small craft for basic sea training of navigation officer candidates. The film was viewed by the members of the Subcommittee with considerable interest. Subcommittee members were particularly interested in how ship handling skills can be acquired on board small vessels and craft. The craft shown in the film was a diesel powered craft of about 100 feet in length, with a pilot house equipped with all the navigational aids generally found on board modern cargo ships. These included a gyrocompass, radar, omega, and decca navigation system. With qualified officer instructors, cadets were exercised in all aspects of rules of the road and navigation, in both open waters and port approaches. While the particular craft shown in the film did not have ship handling characteristics scaled to large vessels, it is possible to design and build a small craft with rudder and propulsion responses scaled to large ocean-going cargo ships. The film portrayed the flexibility and training effectiveness of a small craft that is properly incorporated in a supervised training program. Frequent repetition of shiphandling tasks on small vessels will better prepare cadets for their subsequent shipboard responsibilities. However, the success of any such program will depend upon the training syllabus and the size, characteristics and equipment on board any such small craft.

(d) *Training on Ship-Handling Simulators.*—The Maritime Administration believes that the use of full bridge simulators is another viable option for the increased sea training requirements of Regulation II/4. In a number of key areas, such simulators provide better training than can be acquired aboard ship. Training in many ship-handling functions can be more effectively achieved on such simulators, and in some areas are likely to be achieved only in this manner. For example, crossing situations and emergency avoidance of an object can be conducted over and over again on a simulator without the risk of a catastrophic accident. This has been demonstrated by experiments conducted by Eclectech Associates who are under contract to the Maritime Administration and the United States Coast Guard to study the role of bridge simulators in mariner training and licensing. The cadet training experiments they conducted on the CAORF facility at Kings Point, New York, demonstrated beyond any doubt the effectiveness of bridge simulators. Additionally, such training could be readily incorporated into the existing shoreside training programs at the State Maritime Academies.

APPROPRIATE COURSE OF ACTION

Mr. CHAIRMAN. In conjunction with the State Maritime Academies, the Maritime Administration has developed an IMCO Equivalency Package which has been submitted to the United States Coast Guard for review and approval, along with a request that Article IX of the Convention be invoked. The primary elements of our proposal for the State Maritime Academies to meet the requirements of Regulation II/4 are: (a) continuation of the existing at-sea training on the Training Ships; (b) a proposed training program for cadets on shiphandling simulators, and (c) training on small craft or vessels.

The Training Ships are the basic resource of the State Maritime Academies for providing the necessary practical sea training for their cadets. We believe training on board the school ships would be complemented by training on bridge simulators and small craft. The combination of these elements would provide a very substantial improvement over the current training, be acceptable as meeting the requirements of the Convention, and be a viable solution insofar as the State Maritime Academies are concerned.

The matter of simulators will be carefully reviewed by the Administration in the course of the Fiscal Year 1982 Budget action during the months ahead.

This concludes my prepared statement Mr. Chairman. I will be pleased to answer any questions the Subcommittee may have.

STATEMENT OF CAPTAIN KRINSKY

Captain KRINSKY. I, too, am pleased to have been invited to participate in this hearing and give my views on the effect that the adoption of the International Convention on Standards of Certification, Training and Watchkeeping of Seafarers 1978 will have on

the maritime education and training program of the U.S. Merchant Marine Academy.

A significant part of the professional training of students at the Federal Academy is the tours of duty that each midshipman has during two quarters of his sophomore year and two quarters of his junior year aboard commercially operated U.S.-flag merchant ships. Midshipmen are assigned to different vessels during these periods of sea training to familiarize them with the performance and operating characteristics of various classes of ships and with the diverse operating requirements of different trade routes. In connection with their practical experience in the performance of watchstanding and other shipboard duties, the students are required to complete written assignments, called the Sea Project, which are carefully designed to assure that, while aboard ship, midshipmen apply the knowledge and skills learned in the academy classrooms and acquire a firm foundation for advanced study upon their return to the academy. In my opinion, this type of seagoing training, involving the performance of the actual duties of merchant marine officers under the tutelage of trained and experienced ships' officers, in the environment of modern commercial vessels, and coupled with the mechanism of interrelating the practical experience with theory through the medium of the sea project, is the most effective means of providing true commercial-ship, hands-on experience for young men and women being trained for careers as merchant marine officers.

Over the course of the past 5 years concerted efforts have been made by the academy administration to maximize the number of days that students spend aboard ship for their practical training. Prior to 1975 the average shipboard time was 250 days. In 1979 in contemplation of the increased sea-time requirement provided in the IMCO convention, the target was again raised, this time to 300 days. The additional days actually assigned to ships resulted from reducing the number of individual assignments from four to five different vessels per tour under the previous program to two vessels per tour, thereby eliminating time spent ashore by the student between vessel assignments. The average number of days onboard ship actually experienced by the class of 1981, which has just completed its at-sea training program, was further raised to 294 days.

We feel any further increase, however, in the number of days beyond the 300 would require a change in the academic schedule. As Mr. McAllister pointed out, we do not believe a further increase is necessary. The best way to achieve our training goals is through a proper blend of training with commercial ships and carefully conducted training making use of the simulator——

Mr. AuCoin. I did not understand your point.

Captain Krinsky. We do not believe additional time beyond 300 days is the best way to achieve our goals. We believe the best way is to make use of simulated training and small-craft training, starting with the training on our training vessel as a base. As Mr. McAllister and others have pointed out, we feel we should take advantage of the technology and state of the art.

In closing, I would like to point out that there is another impact that IMCO might have, and that is in our so-called dual license

program. This would have to be reevaluated because of the difficulty we would have in giving the student deck and engineering training. This is something we will have to take a look at in the future.

Mr. AuCoin. At the worst, what kind of problems are those?

Captain Krinsky. The demise of the dual license program. In the dual license we are trying to cram into those 300 days, both deck and engineering training. Under the best of circumstances, it is possible that the total time at sea of 300 days would be counted toward the time required for deck training. We would then make it our business to assure that we have at least 6 months of supervised bridge watchstanding in accord with IMCO. Then we would add to that the simulated and small-craft training to make up for the balance of the time.

Mr. AuCoin. What was the percentage of dual-license graduates in your last graduating class?

Captain Krinsky. Over a number of years, we average about 20 graduates per class. We start with one group of 30, and it drops down to 20.

Mr. AuCoin. Can it be called a significant problem?

Captain Krinsky. Only in a sense that the dual program has been successful. The people are sought after, it was considered to be a move in the right direction, but in terms of the total numbers involved, I cannot say it is as significant as one of the other curriculums would be.

I would also be glad to answer any additional questions.

[The statement of Capt. Paul L. Krinsky follows:]

Prepared Statement of Capt. Paul L. Krinsky, Dean, U.S. Merchant Marine Academy

Mr. Chairman and Members of the Subcommittee, I, too, am pleased to have been invited to participate in this hearing and give my views on the effect that the adoption of the International Convention on Standards of Certification, Training and Watchkeeping of Seafarers—1978 will have on the maritime education and training program of the United States Merchant Marine Academy.

A significant part of the professional training of students at the Federal Academy is the tours of duty that each Midshipman has during two quarters of his sophomore year and two quarters of his junior year aboard commercially operated U.S.-flag merchant ships. Midshipmen are assigned to different vessels during these periods of sea training to familiarize them with the performance and operating characteristics of various classes of ships and with the diverse operating requirements of different trade routes. In connection with their practical experience in the performance of watchstanding and other shipboard duties, the students are required to complete written assignments, called the "Sea Project," which are carefully designed to assure that, while aboard ship, midshipmen apply the knowledge and skills learned in the Academy classrooms and acquire a firm foundation for advanced study upon their return to the Academy. In my opinion, this type of seagoing training, involving the performance of the actual duties merchant marine officers under the tutelage of trained and experienced ships' officers, in the environment of modern commercial vessels, and coupled with the mechanism of interrelating the practical experience with theory through the medium of the Sea Project, is the most effective means of providing true commercial ship, hands-on experience for young men and women being trained for careers as merchant marine officers.

Over the course of the past five years concerted efforts have been made by the Academy Administration to maximize the number of days that students spend aboard ship for their practical training. Prior to 1975 the average shipboard time was 250 days. For the Class of 1977 the target date was raised to 270 days per student, to be accomplished through eliminating a part of the summer leave period and assigning each student to sea duty immediately after completing the last final examination at the end of the 2nd or 4th Quarter. The actual average number of days spent aboard ships for the Class of 1977 was thus raised to 272 days. In 1979

in contemplation of the increased sea time requirement provided in the IMCO Convention, the target was again raised, this time to 300 days. The additional days actually assigned to ships resulted from reducing the number of individual assignments from four to five different vessels per tour under the previous program to two vessels per tour, thereby eliminating time spent ashore by the student between vessel assignments. The average number of days on board ship actually experienced by the Class of 1981, which has just completed its at-sea training program, was further raised to 294 days.

The total available time under the present schedule for shipboard training averages 390 days. Experience has shown, however, that the highest percentage of actual on-board time attainable is approximately 77 percent of this available time. A higher percentage of utilization is effectively precluded by such limiting factors as:

1. The diminished number of berths available on American flag vessels;
2. Competition for cadet berths by students from the State Maritime Academies, the U.S. Coast Guard Academy and the MEBA Union School;
3. The use of cadet accommodations for company trainees and representatives;
4. The delay encountered in obtaining ships with separate cadet quarters to accommodate male/female assignments;
5. The problem of coordinating cadet assignment schedules to ship schedules; and
6. The need to provide at least minimal leave time for midshipmen between periods of residence at the Academy and tours at sea duty.

Accordingly, any further increase in the number of days of assignment of Midshipmen of the U.S. Merchant Marine Academy to shipboard training would require a major change in the academic schedule and a concurrent modification of the academic curriculum.

There is, however, a serious question as to whether such further increase in the number of days of assignment of students to commercial vessels at the expense of the in-residence academic program, would be the most desirable way to further the training of our students as merchant marine officers. It is our opinion that the requirements of the IMCO Convention should be the occasion of introducing into our maritime training program more innovative processes that would significantly enhance the content, quality and effectiveness of developing qualified and experienced merchant marine officers. The concept of "equivalent" is recognized in the language of Article IX of the Convention which permits "other educational and training arrangements provided that the level of sea going service, knowledge and efficiency as regards navigational and technical handling of ship and cargo ensures a degree of safety at sea and has a preventive effect as regards pollution at least equivalent to the requirements of this Convention." We strongly feel that as far as the training program of the U.S. Merchant Marine Academy is concerned, far greater benefit can be assured by a careful blending of the present 300 days of commercial ship experience with supervised use of bridge simulation and training on small craft. It is our judgment that such a program will be more beneficial than by simply expanding the period of training aboard commercial vessel for deck candidates to a full 365 days.

Current state of the art permits the construction of bridge simulators which can produce the complex behavior of a ship over a full range of operating conditions. Thus, a student can be exposed to a multiplicity of scenarios which can teach him or her how to react to critical events and dangerous situations which would be avoided at all costs if the student was embarked on a real vessel. By constant repetition of such experience, not readily available at sea, a student's learning can be greatly enhanced and the simulator when carefully and properly used can serve as a uniquely valuable and complementary adjunct to on-the-job training.

A small vessel can also be a most effective supplemental training platform. New students can be introduced to basic skills and concepts of seamanship and navigation by conducting a series of training voyages, in and around Long Island Sound, which concentrate on the handling of mooring lines, anchors and ground tackle, steering and keeping a lookout, piloting, emergency drills, and collision avoidance. They will thus be better prepared for sea duty aboard oceangoing vessels and will benefit more from their subsequent shipboard training experiences. Small vessel voyages during the first class year can then focus on more advanced skills such as ship handling, docking and undocking, supervising a bridge watch, and emergency maneuvers. As in the case of simulation, constant repetition can expose the student to more actual experience in a shorter period of time than can be obtained aboard a merchant ship over several voyages.

I am compelled to stress at this time that in our view the 300 days of commercial shipping experience is the "base" upon which we would build through simulation and small craft programs. It is our belief that concentrated training through the use of simulators and small craft, as described above, can actually be designed to

produce the equivalent of approximately 65 training days in far less "real time." In this manner the U.S. Merchant Marine Academy would propose to meet the total 365 days IMCO training requirement for deck officers effectively and consistent with quality professional standards and without drastically impacting on our total academic program.

The matter of simulators and small craft available to us at Kings Point for such training will be carefully reviewed by the Administration in the course of the Fiscal Year 1982 Budget Action during the months ahead.

Another significant effect of the adoption of the provision of the IMCO Convention relates to the dual licensing program presently offered to a certain selected group of students at the Academy. The additional sea time required under the terms of the Convention in the training of deck cadets will seriously impact on our ability to continue to provide the opportunity for midshipmen to obtain both deck and engine officer licenses within the regular four-year course of training at the Academy.

Mr. Chairman, that completes my prepared statement, I would be pleased to respond to any questions that you or members of the Subcommittee may have.

Mr. AUCOIN. Mr. McAllister, on page 11 of your statement, you briefly outline the contents of the equivalency package which you have supplied to the Coast Guard. Would you elaborate on the amount of time you have recommended to the Coast Guard be permitted on training ships, small craft, and simulators? And to the degree that might involve a great deal of documentation, the Chair would like you to provide that to the subcommittee. But I am wondering if for now you could elaborate on how you suggested to the Coast Guard the components of that mix would be allocated values of time. How much time are you recommending?

Mr. MCALLISTER. An April 28, 1980, letter to the Coast Guard, which was sent by Mr. Friedberg to the Coast Guard, enclosing the so-called equivalents package—Mr. Friedberg would be more familiar with this than I. Subject to your correction, Mr. Friedberg, I do not believe there were any specific time equivalents used.

Mr. AUCOIN. You had no suggestions for the Coast Guard as to time?

Mr. FRIEDBERG. We did suggest to the Coast Guard that substantial portion of the incremental time could be satisfied by simulators such as 3 to 4 months. We did suggest to the Coast Guard that depending on their characteristics, the small craft portion could be the equivalent—and unless I go through this package verbatim to look exactly for it—it certainly has been conveyed to the Coast Guard verbally in our discussions. We have been suggesting to the Coast Guard similar amounts of time for small craft, 3 to 4 months. In arguments concerning supervised training on the training ships themselves as distinct from time as an observer on a commercial ship, since the training ships are dedicated to training and since the cadets are supervised, that in terms of the IMCO timeclock punching, if you will, this should be counted as part of their time, in other words, instead of 6 actual months, 9 equivalent months, because it is supervised.

I would have to go through the whole package one by one——

Mr. AUCOIN. Would you supply that to the committee for our records?

Mr. FRIEDBERG. Yes.

[The information follows:]

UNITED STATES DEPARTMENT OF COMMERCE
Maritime Administration
Washington, D.C. 20230

April 28, 1980

Rear Admiral Henry H. Bell, USCG
Chief, Office of Merchant Marine Safety
United States Coast Guard
Washington, D.C. 20590

Dear Admiral Bell:

You will recall that at our meeting last year with the Presidents and Superintendents of the State maritime academies and colleges, relative to the IMCO requirement for one year minimum sea time for candidates for deck officer certification, it was decided that the Maritime Administration should develop an equivalency package for evaluation under Article IX of the Convention. Article IX as you know, permits "other educational and training arrangements" which "ensures a degree of safety at sea and has a preventive effect as regards pollution at least equivalent to the requirements of this Convention."

In conjunction with the academies, we developed the enclosed equivalency package. It represents the Maritime Administration position with varying degree of support from the academies. We would like to emphasize that the package is intended to provide maximum flexibility regarding applicability of its parts in the programs of the individual academies. It is not intended to force uniformity among the academies in the mix of elements which would be considered for equivalency. Each academy program should be reviewed separately.

Bridge simulators are an integral part of this package. We are proposing that federal support be provided for their acquisition. Therefore, we request that any implementing steps of the provisions of the Convention be coordinated with our ability to bring simulators on line. Should we be unsuccessful in our efforts, then we request that any implementation steps await coming into force of the Convention internationally.

We hope that you can concur in our position on equivalency and urge that Article IX be invoked.

Sincerely,

[illegible]
ARTHUR W. TRILDUERG
Director
Office of Maritime Labor
& Training

Enclosure

[The enclosure has been retained in the subcommittee files.]

Mr. AUCOIN. I want to go back to a question Admiral Bell raised. Could Mørad indicate which nations in the formulation of the convention were the ones which pushed originally for the 2 years at-sea requirement, forcing as it did, the compromise?

Mr. FRIEDBERG. It is very difficult for me to identify any specific nation. I can give you a picture of what took place on the scene, though, adding to what Admiral Bell said.

Prior to the promotion of the 2 years, there was another action that precipitated the action that gave us the final problem. That was that the concern of the Group of 77, the developing countries, for the amount of time it would take for them to develop top officers, the chief engineers and particularly masters, led to an effort to decrease certain of the sea time at the higher levels.

Certain concessions were made there in terms of the movement of individuals from some of the middle ranges of officers to the unlimited master levels. In making those concessions there was concern by the developed maritime nations that the totality of time starting out as the very junior officer all the way up to master had to be reviewed again as though nothing had happened. That is where the move for the 1-year sea time came solidly into the conference. It was a reaction to a suggestion made by the higher levels.

Mr. AUCOIN. What nations were instrumental?

Mr. FRIEDBERG. I think I would have to avoid identifying individual nations. It was a collective action. But basically, you had concessions being made to the developing countries and concern for their ability to develop masters, and then reaction to that by tightening up the sea time requirement to develop third mates.

Mr. AUCOIN. Do we have any experience in the case of some of the other major seafaring nations as to what degree they use a mix today of small craft and simulators? Take the top two or three nations and give the subcommittee an indication of how they are handling these alternatives.

Mr. FRIEDBERG. The United Kingdom is a good example at the present time, since there is a good simulator technology in that area. In the United Kingdom, most of their academies are more like our State academies in terms of financing from regions and industry. They have been offering sandwich operations in which individuals get their seatime between phases of academic training. The United Kingdom has not had the problem of seatime. That is 12 months in terms of clock time. The United Kingdom is going to simulators. They have a night-only simulator in Southampton, a very interesting simulator. They are going to full-day simulators in Wales and in certain other of their maritime schools. In fact, it is my understanding they are going to install from five to six full-day simulators that will just about blanket all their schools.

The Dutch, of course, started— —

Mr. AUCOIN. In the case of the United Kingdom, what portion of their so-called sea training is given over to the use of simluators?

Mr. FRIEDBERG. They are just getting into the question of simulators. They have no substitution problems, so they are not looking at the issue of equivalency. They will build the simulators into their programs at the academies. We will have to see how they are going to do it. Most countries just starting in with the use of full-

bridge simulators are at the same stage as we are, just starting to build them. They have more than we have.

Mr. AuCoin. How would you compare the simulators in the United Kingdom to the one at Kings Point, for example?

Mr. Friedberg. We have two here.

Mr. AuCoin. I know that. How do they compare with those in the United Kingdom?

Mr. Friedberg. We have CAORF, a research simulator, with all its whistles and bells like a super Cadillac. The one at MSI, I see you have a representative from MSI, is a rather straightforward, basic training simulator. The night-only-vision deck simulator at Warsash is at one stage, a little less than the MSI simulator. The ones that are going in now at the British schools will be in my opinion one step above the MSI, and a couple of steps below CAORF.

Mr. AuCoin. What is the cost range?

Mr. Friedberg. In dollars maybe about $5 million apiece. I am not absolutely sure.

Mr. AuCoin. How many do you say you understand the United Kingdom has?

Mr. Friedberg. The schools in the United Kingdom are going in with a buy for five or six of them at the present time.

Mr. AuCoin. But you have no knowledge or even an indication of how many that will fit into any academy?

Mr. McAllister. As to sea time, simulator time?

Mr. Friedberg. No, I have had some very preliminary correspondence with the schools. It indicates they are struggling as we are. They are going to install and try them. We will have the benefit shortly of 2 to 2½ years of research in the use of simulators in training, and should have a better ability to blend in the simulators in our academic curricula.

Mr. AuCoin. As far as you know, the United Kingdom is not setting any goals for itself as to the dominance in the mix?

Mr. Friedberg. No. As to the mix between actual sea time and simulators, I do not believe they have that as the same type problem we have. They see simulators as supplemental and as adding to the quality of training.

Mr. AuCoin. Are you saying in the United Kingdom, it appears that simulators would be used for upgrading of the officers' education?

Mr. Friedberg. It is my understanding the simulators I am mentioning now are for basic licensing. We intend to build it into that level of program.

Mr. AuCoin. Someone said simulators would have their best use as an upgrading educational device rather than as a licensing experience. How do you react to that? Do you agree or disagree, and why?

Mr. Friedberg. I am going to disagree, because you have given me no choice. If I have to agree, I would have to say it is better for upgrading than original. I want to say it is good for both and it is desirable for both.

I think it has a definite, very distinct value in the original licensing program. We have run into situations where in use of the simulators in our research, up to this point, the remarkable and

simple training advantage is that they add a tremendous value to the individual, the simple ability of having the experience of giving helm orders, which a third mate will have to do, never having had the experience except in a simulator. He must now give a helm order in a loud voice. Also, in emergency situations, it teaches the ability to experience and be faced with a kind of decision process. The simulators have those advantages.

I do not know that you want me to carry on for a long period of time on this point.

Mr. AuCoin. In aviation, it is my understanding the FAA, from the testimony FAA has provided to the committee, simulators are used for experienced pilots for largely an upgrading purpose. What is different about aviation from the training with which we are concerned here that would change the use of simulators and suggest that perhaps simulators were better up front, in the initial licensing training?

Mr. Friedberg. Well, I do know that simulators are used even when you only have your learner's ticket, if you would, it is part of the ground training. You run into a more elaborate simulator if you are an experienced pilot and you are moving from one type aircraft to another. But simulators are used for totally green trainees as part of their ground training. I have not considered that there should be a distinction in the use of simulators. You might make a distinction in the kind of simulator you are going to put together, but I do not think it appropriate to consider that simulators generally have a greater advantage in upgrade training from one level of license to higher levels of license as against the original licensing. I think it has equally valid and very worthwhile roles at both levels.

Mr. AuCoin. In that regard it is my recollection that your recommendation to the Department in this budget cycle was for five simulators, which was denied. I wonder if after that experience and more thought, Marad intends in the next budget cycle to give more careful attention to the point you just made, namely, the question of the different types of simulators; if there is a case where there are different types of simulators, which academies might be best suited to a particular type? Should in fact, every academy have a simulator? Those are the specific questions. The bottom line of all that is, can the subcommittee expect to see a more sophisticated recommendation in the next budget cycle? I would call the last one rather unsophisticated.

Mr. Friedberg. Well, you elicited from Mr. Nemirow at the last budget hearings our listing of simulators in the 1981 budget. We are continuing our refinement of the characteristics of the simulator, particularly as we get the results of research we are going into. We are continuing our own efforts to discuss this within the administration as to where we are going in our budget cycle. And that is the best I obviously can answer to you as to what you will see next year. It has to be thought through and has to be the subject of decisionmaking.

Mr. AuCoin. You are in the business of maritime education, and I would pose to you the question, should every academy have a simulator, based on your best judgment today? Should they or should they not? Does each academy need a simulator?

Mr. FRIEDBERG. Each academy needs access to, and that means should have, a ship-handling bridge simulator. These devices represent probably the most significant training advance for navigating officers that we have seen for decades.

Mr. AUCOIN. So you feel as of now that it is most desirable for each academy to have its own simulator as opposed to a very elaborate sharing program; am I correct?

Mr. FRIEDBERG. That is correct. Unless these things are built into the curriculum I do not see how in the world we can justify a program of sending a group of cadets for a short period of time and kissing it off, hoping it works. These things should be built in academy by academy.

Mr. AUCOIN. Captain Krinsky, do you have the equipment to meet the proposed requirements under the proposed convention? If not, which I suppose will be the answer, what do you think would be required in terms of costs to prepare yourself to meet the needs?

Captain KRINSKY. I am not sure I understand the question. You mean the simulator and small craft?

Mr. AUCOIN. Yes.

Captain KRINSKY. Like Mr. Friedberg mentioned, I think they are talking about $3 to $5 million for a simulator, which we do not have built into a budget at the time. In terms of small-craft training, there would have to be additional consideration there. But I do not have hard numbers I can bandy about.

Mr. AUCOIN. Can you make an estimate in the small craft situation?

Captain KRINSKY. Probably in excess of $300,000.

Mr. AUCOIN. So, for your academy alone, we are talking about a cost impact of $5½ million.

Captain KRINSKY. It is obvious as to the simulators that is what we are talking about. Now the small-craft cost would probably be a one-time cost. Then there would be follow-on costs to operate the craft. While small-craft training has been a part of the Academy training, it has not been looked upon as a means of attaining equivalency training. So this would involve additional costs.

Mr. AUCOIN. I want to ask you one final question on the small craft. In turning to this equivalent form of training, what kind of small craft do you have?

Captain KRINSKY. A converted Navy tug, ATA class, 143 feet long. Tonnage, 850 gross tons. We have been using it as a supplement up to now. It has been refitted with a bow thruster and it has a number of features making it useful as a training craft.

Mr. AUCOIN. Mr. Emery.

Mr. EMERY. Thank you very much, Mr. Chairman.

In order to really get a handle on the training advantages and disadvantages of these three methods—the traditional training ship, small vessel, and simulator—will you tell us what some of the advantages are with a simulator. In order to understand what we are doing we have to understand.

Captain KRINSKY. I will try. I will use a simple example. You can put together in a simulation situations involving other vessels, crossing situations, and dangerous situations, which you obviously would not try to do using a regular ship. As a matter of fact you probably would not even want to do that using a small craft. You

can put the ship in an endangering position and critique it and you can critique the skills that cannot be duplicated elsewhere. This is one of the major advantages of simulation.

What I am saying is there are certain things you just would not do with a large vessel, whether using it for original training or advanced training of pilots, master, whatever.

Mr. EMERY. What about underway operations or repairs or handling of the vessel itself? Are simulators used for those purposes, and are they sufficient?

Captain KRINSKY. This is one of the major characteristics of the bridge-handling simulators you have today. They are programed so they would respond as a regular ship would respond.

Mr. EMERY. Are they realistic?

Captain KRINSKY. I think they are. Most everyone I have spoken to who has had experience with simulators says they are. The feedback I have gotten back universally is that simulation, as Mr. Friedberg says, is one of the major advances insofar as training within the past decade.

Mr. EMERY. Would you anticipate simulation of loading and offloading of cargoes?

Captain KRINSKY. Yes. We have those things available today. As a matter of fact there are some in existence at some of the academies now. There are different types of situations in which simulation is useful. Sometimes a simulation can be used to transfer skills to the actual equipment. Other types of simulation will be used to teach generalized knowledge. All these things are available. I think all of them significantly enhance training and enable you to do things you cannot do in on-the-job training.

Mr. EMERY. Is it your intention to replace certain aspects of full-size training vessels, or are you trying to instill skills and experience on smaller vessels?

Captain KRINSKY. No. We look upon the small-vessel training as an enhancement of the overall training. In the initial phases it is valuable to introduce the individual to the basic principles. This will enable the student to take better advantage of training when he goes aboard the big vessel. Subsequent to training on seagoing vessels, small vessel training can be used to undertake more complicated tasks. Coupled with a simulator the total package is better than anything we have today using a single source.

Mr. EMERY. I wonder if the other gentlemen on the panel have comments they would like to add to what Captain Krinsky has said.

Mr. MCALLISTER. I would like to add a comment to the realism of the simulator. Anyone who has been at Kings Point will understand what I am about to say. I was on a bridge simulator of an 80,000-ton tanker coming into New York Harbor. The effect is nothing less than astonishing.

Mr. EMERY. For the record, I have had a similar experience. I had an opportunity to visit a simulator at Baltimore, and I was very impressed with the ability of that device to simulate New York Harbor as well. In fact, I successfully piloted the ship from one end of the building to the other. But it is an amazing experience and has some use, I am sure. I am trying to get a handle on

whether that as at-sea experience provides complete training and is adequate.

Mr. FRIEDBERG. I do not believe we are ready at all to advocate complete substitution of simulators for onboard experience. I know there are some who would argue to that. In fact it is my understanding, at any rate, in transition from one aircraft to another, the FAA accepts simulator time completely. But we are not ready for that. As Captain Krinsky has said, they would be supplemental to the existing level of at-sea training in the academies, State academies and Kings Point, and this would enhance the quality of training at these schools.

Mr. EMERY. Are there sufficient differences between the various characteristics of different kinds of vessels which necessitate experiences, differences between large tankers and small tankers, ships constructed differently? How many of those different characteristics can you reproduce on a simulator?

Mr. FRIEDBERG. You can duplicate or simulate, particularly in the ship-handling characteristics, by programing whatever set of characteristics you want to put into the program. You can take one ship in, snap back to approach, and put another ship in.

Mr. EMERY. So you anticipate having a whole fleet of various characteristics and designs?

Mr. FRIEDBERG. Yes. We are envisioning certain selection. I think how much you want to give a cadet, it is a matter of retention. You cannot force all of them.

Mr. EMERY. Moving back to the realm of at-sea training. Over the time I have served on this committee, there has been considerable discussion as to appropriate reliance on commercial vessels as training vehicles. It has been pointed out inasmuch as students would have an opportunity to watch personnel operate a ship underway on a normal commercial voyage, that might be useful hands-on training. But certainly such training would be very limited because no commercial vessel would stop dead in the water and allow cadets to change equipment, make repairs, or actually operate the ship in touchy situations. So in fact is it not true the use of reliance on commercial vessels is somewhat limited?

Mr. FRIEDBERG. I think there are limits, advantages, and disadvantages to each type of training. We have the State academies dealing with their training ships, and a number of the State academies are taking advantage of it by putting their individuals on commercial vessels. I would not say it is limited. I think each has its strong points and each has it weak points.

I will make a strong point out of a weak point. The boredom on the bridge at sea on a commercial vessel is something they do not think about putting on a simulator, but it might be something you might want the cadet to know occurs and how to cope with it. So the mix has great attraction.

Mr. EMERY. You anticipate a cadet might spend some time on a vessel where he is subjected to the seagoing-laboratory situation and then given an opportunity to see a modern up-to-date vessel underway?

Mr. FRIEDBERG. Yes, where that mix can be worked in.

Captain KRINSKY. I think there is a slight misconception about the role of a cadet aboard a commercial ship. Whether it be one of

the State students aboard the ship, or one of the Kings Point students, he or she is part of the ship's company. Granted, it is not the same as performing duties under supervision, minute by minute. This is a matter of fact, not conjecture. Also, they are getting instruction. The ship's officers do take the time to teach the cadets. While there is not the same quality control, it is there.

Mr. EMERY. The point I am making is that a commercial vessel is there primarily for whatever role it is designed to perform. Inasmuch as that will be the top priority of the ship's crew and the company that owns the vessel, in situations where that becomes complicated by whatever the situation might be, the trainee will take a secondary role.

Captain KRINSKY. That is why the simulators will provide necessary knowledge.

Mr. EMERY. You do not see there would be opportunities where, I should say occasions where student activities would be put into hold?

Captain KRINSKY. There are obviously tradeoffs, and it is obvious I am biased. I think the simulator is important.

Mr. FRIEDBERG. We do not see any tradeoffs.

Mr. EMERY. The final question I would ask is, given the condition of various State academy vessels, do you see problems with training a young cadet today on a vessel that is obviously at the opposite end of the spectrum in terms of technology, equipment, and so forth? Do you think they are getting useful training time on those vessels, or would their time be better spent on a more modern vessel?

Mr. FRIEDBERG. Particularly where you talk about deck cadets where the difference is not that substantial, where the electronics are there, the basic electronics are there and can be added, there is really not that much difference between the training ships, albeit they may be old, 30 years old. Some of the deck navigation equipment has been described, and you can see it compares favorably. So there is no problem there.

Mr. EMERY. You think the basic ship-handling experience and familiarity with equipment would be the same on these ships as in simulators or more modern ships?

Mr. FRIEDBERG. The simulators add to the training a person gets on a State ship or a commercial ship. Each does its own job.

Mr. EMERY. I have no further questions, Mr. Chairman.

Mr. AUCOIN. We are going to have to leave in a few moments. While we are gone I will ask the staff director to continue the questioning until we return.

Gentlemen, I want to thank you for your testimony. We may have a couple of additional questions.

I understand an emergency has arisen, and I would like the indulgence of the next panel so the subcommittee can call Admiral Benkert to deliver his testimony.

STATEMENT OF ADM. WILLIAM M. BENKERT, USCG (RET.), PRESIDENT, AMERICAN INSTITUTE OF MERCHANT SHIPPING

Admiral BENKERT. I have a short statement. With your indulgence, I would like to read short excerpts from it to open my testimony, sir.

Mr. Chairman and members of the subcommittee, I am Rear Adm. William M. Benkert, USCG (Ret.), president of the American Institute of Merchant Shipping. AIMS is an association of owners and operators of deep-draft American-flag ships aggregating over 10 million deadweight tons. We do appreciate the invitation to testify here today.

We understand this oversight hearing is intended to provide a forum for discussion of sea training requirements and ways to meet them. We recognize that maritime training is at an important stage of evolution because of increasing demands being placed on officers and crew through regulatory requirements and the many new sophisticated systems for merchant ships. I am speaking here of highly advanced navigation, propulsion, cargo handling, and safety systems found today on many different kinds of vessels.

In view of these demands, AIMS 2 years ago instituted a training committee within our membership, with a full-time training coordinator to assist member companies in evaluating their future training needs and assessing the capability of existing or future training facilities to meet those needs.

AIMS has been a strong supporter of higher proficiency for seamen and was deeply involved in the 6 years of effort by IMCO which culminated in the 1978 International Convention on Standards of Training, Certification and Watchkeeping for Seafarers. While that convention unfortunately has not yet been ratified by the United States, we know that the U.S. Coast Guard is proceeding, as it always has in the past, with a continuing program of upgrading requirements for U.S. seafarers. The United States, among other countries, has a reputation for requiring high standards of its seafarers. For this reason, the impact of the STCW convention on us will really be quite minimal. Other than the full 1-year sea time requirement for certain prospective third officers, the convention really does not present any radically new requirements when compared to current or contemplated domestic regulations. Even here, article IX of the convention, the equivalents provision, allows for flexibiity in putting together combinations of approved practical training to meet the sea-time requirement, among other expanded regulatory requirements and recommendations.

Of course, the Coast Guard will want to be assured—and so should we all—that any alternative training means permitted to satisfy a portion of the seatime requirement in fact does the job. There is a strong conviction among AIMS 'member companies that adequate hands-on experience must be obtained. There are several avenues that may be followed to obtain seatime, including using small vessels and commercial ships to supplement school ships. Training institutions should make every effort possible to achieve the 1-year seatime requirement without resorting to alternative means of training. For example, Federal and State academies could be more flexible in their academic scheduling so as to allow maximum use of training vessels and commercial vessels for their deck cadets to get the required time.

I would like to emphasize that the convention's controversial 1-year seatime requirement applies only to the initial qualification of third mates and that great care should be taken in permitting

simulator substitution for the basic sea experience required of an individual at this stage of his capability development.

Simulator training, if properly used, can undoubtedly enhance the skills of masters, senior deck officers and, of course, engineers in their specialty fields. The 1-year seatime requirement should not be used, however, as a boot strap to justify automatic acceptance of simulator training in lieu of portions of the sea-time requirement. In fact, no one alternative training aid mechanism should normally be relied upon as the equivalent to practical seagoing experience; training procedures in the maritime industry must remain flexible so they can adapt to new techniques, developments, and regulatory requirements, and the need for improved levels of safety.

Thank you for this opportunity to present the views of the American Institute of Merchant Shipping on the important subject of maritime training.

I would be pleased to answer any questions.

Mr. PANSHIN. Thank you for your testimony. Admiral Benkert, am I not correct that you headed the U.S. delegation to the 1978 IMCO convention?

Admiral BENKERT. Yes; sir, I did.

Mr. PANSHIN. It is the matter of that convention and the 1-year sea-time requirement in the convention that have come up in the questioning a couple of times today. In view of your role in that delegation, would you please inform the subcommittee for the record how that 1-year sea-time requirement for initial licensing of third mates was arrived at.

Admiral BENKERT. I think, sir, Mr. Friedberg has given a fairly thorough and certainly an accurate description of how the 1-year seatime requirement was arrived at. The only thing I would add is this: I think the question was asked earlier as to which countries desired to insure this level, of initial sea training. My recollection is that this was primarily an effort of the Scandinavian countries and the countries of the European Economic Community. These countries were strongly in favor of this particular requirement because of the concessions that were developed during the course of discussions resulting from the efforts of lesser developed countries, who were very concerned about their ability to develop their own maritime capability in the sense of officer qualifications as the officer's service time progressed.

From a seaman's point of view I would like to throw in a personal note. I do not feel a 1-year sea-time requirement for a license as a third mate of unlimited tonnage is an exorbitant amount of time. I feel this amount of time, with certain equivalents thrown into the hopper, is proper for the experience level that is needed for the individual to assume the job of third mate on an oceangoing large vessel today.

Mr. PANSHIN. Thank you. I am not sure that I heard this responded to earlier, not by you, but by the other witnesses: What was the initial position of the United States with respect to sea time on entering the convention?

Admiral BENKERT. As I recall, sir, our initial position on this was that we were in favor of what we presently had in our own system, a basic 6-month requirement. I think it was developed over the years, preparatory to the conference, during the deliberations of

the Standards of Training and Watchkeeping Subcommittee. This was the accepted position going into the conference—a 6-month concept with additional time to be determined by the administration. It was a rather flexible arrangement going into the conference, sir.

Mr. PANSHIN. Your views are very clear, but to pursue that point, do you accept simulator training as a partial means of meeting any portion of the 1-year at-sea requirement under article IX of IMCO for initial licensing of deck officers?

Admiral BENKERT. I would answer this question, "yes," on the premise that the simulator training was fitted into the entire program. In other words, simulator training has to be a piece of the entire academic and practical program in training cadets to become third mates. I would accept this; yes, sir. I do think, and I believe we stated this view in my formal statement, that care must be taken in utilizing the simulator for this purpose. I think the gentleman from Kings Point earlier stated this quite well. You have to fit the simulator into your entire training and academic program. I might add, sir, I feel the same about the small-vessel training. I think the use of small vessels in providing a portion of the 1-year sea-time requirement is very good. I feel very strongly that an individual, early in the game, before he knows a damn thing about going to sea, can learn a tremendous amount by spending time on the bridge and aboard a small vessel. There are many, many things that can be learned as a seaman if I might say so, aboard a small vessel, and, I have some experience in this myself, in the past.

Mr. PANSHIN. Indeed you do.

Minority counsel has a question.

Mr. LOSCH. There is a comment in Admiral Rizza's testimony that the State academies were not consulted in advance.

Admiral BENKERT. That is a lot of baloney, and I can tell you why. I say this very specifically. The Federal academy and the State academies were sent material time and time again covering what was going on with regard to the preparations at the Standards of Training and Watchkeeping Subcommittee prior to the time of the conference.

I would agree with Admiral Rizza that I, as chief of the marine officer safety, I do not recall discussing this with him personally prior to the time of the conference, but I do know many, many pieces of material, the notifications of the meetings of the subcommittee, the notification of the meetings of the Shipping Coordinating Committee working group under the auspices of the State Department, were not only sent out to everybody on our mailing list, but the material that was going to be discussed at particular meetings was specifically entered into the Federal Register for anybody and everybody to join in the process of the development of a U.S. position at that conference.

Now there may have been some misunderstandings about this, but I will say without any equivocation at all that the whole program, the whole development of the U.S. position prior to the conference itself, was wide open for participation by anybody who wanted to participate. We in the Coast Guard felt some facets of the maritime industry were rather recalcitrant in coming forward.

Mr. LOSCH. I felt the record should be clarified on that point, because his statement will be made a part of the record.

Admiral BENKERT. I do not want to get into an argument with the admiral, but the Coast Guard did make a strong and overt attempt to get everybody involved. This was through a series of meetings which occurred at least twice a year for at least 6 years before the actual conference itself.

Mr. LOSCH. Thank you. I wanted to clarify the record on that point.

Mr. PANSHIN. Admiral Benkert, thank you for your testimony.

Let me call the next panel, the California Maritime Academy, Rear Adm. J. P. Rizza, USMS, president; Maine Maritime Academy, Rear Adm. E. A. Rodgers, USMS, superintendent; Massachusetts Maritime Academy, Commodore William R. Hendy, Jr., acting president, and Capt. Geoffrey Motte, vice president of academic affairs; and State University of New York Maritime College, Rear Adm. S. H. Kinney, USN (Ret.), president.

STATEMENTS OF REAR ADMIRAL J. P. RIZZA, USMS, PRESIDENT, CALIFORNIA MARITIME ACADEMY; REAR ADM. E. A. RODGERS, USMS, SUPERINTENDENT, MAINE MARITIME ACADEMY; COMMODORE WILLIAM R. HENDY, JR., ACTING PRESIDENT, AND CAPT. GEOFFREY MOTTE, VICE PRESIDENT OF ACADEMIC AFFAIRS, MASSACHUSETTS MARITIME ACADEMY; AND REAR ADM. S. H. KINNEY, USN (RET.), PRESIDENT, NEW YORK MARITIME COLLEGE

Mr. PANSHIN. Admiral Rizza, may we hear your testimony.

STATEMENT OF ADMIRAL RIZZA

Admiral RIZZA. Mr. Chairman, distinguished members of the House Ad Hoc Select Subcommittee on Maritime Education and Training, and ladies and gentlemen:

For almost 2 years we at the California Maritime Academy have been studying the revised standards of sea training as proposed by IMCO. Therefore, we take this legislative mandate seriously; consequently, we are looking at the best and most efficient method of providing the practical training for merchant marine officers. This training must give them confidence in their ability to handle emergencies at sea and in port, and the detailed knowledge and the specific skills required to carry out all their responsibilities rapidly and efficiently. At the California Maritime Academy we have been developing an increasingly varied spectrum of vessels, operational laboratory equipment, and simulation systems to meet this need in the most efficient and effective way.

In the course of 4 years at the academy, the nine semesters spent on campus by our midshipmen consist of a daily routine which is best characterized as spent a half day in the classroom and a half day in our shoreside laboratories, on our training ship engaged in practical work, on our smaller diesel vessels, and our small boats, and in our simulation laboratories. This routine is the daily learning experience provided to our midshipmen on campus for roughly 8 months out of each year. It is a routine that is packed intensively with the practical skill training required to produce the finest deck officer and the finest marine engineer. I make this point first so

that you will better comprehend that we rely only partially upon our current program of 6 months of sea time on the training ship to provide a practical foundation of seamanship, navigation, and engineering skills for our graduates.

Now let me address briefly the IMCO standards for sea training which this subcommittee is considering today. We have no quarrel with the proposed regulation for marine engineering officers, so I will focus on the proposed IMCO sea training requirements for deck officers, regulation II/4, paragraphs 2 and 2(c).

The basic qualification in this paragraph, in my opinion, provides adequate international experience standards for a seaman applying for a deck officer's license. The candidates must serve at least 1 year at sea.

However, the qualifying language does not provide for the deck graduates of the State maritime academies who receive a total of 6 months' intensive training at sea under the strictly supervised, precise regimen of the nautical training vessel whose only mission is training.

The lack of consideration in these regulations for our program of 6 months of sea training probably was not a deliberate oversight by the U.S. delegation to the conference. The State academies simply were not represented, nor were we consulted in advance. This omission is particularly unfortunate as the State academies represent over 100 years of continuous experience in the education and training of U.S. merchant marine officers. Indeed, the bulk of the licensed officers afloat and ashore in the U.S. maritime industry today are graduates of these venerable maritime institutions. The State maritime academies have a well-proven system of officer training that is evidenced by the excellence of their product.

Since the IMCO convention already has been agreed to by its international parties, the State maritime academies have recommended through the U.S. Maritime Administration that the U.S. Coast Guard take immediate action under the provisions of article IX of the convention, "Equivalents," which provides in paragraph (1) for "* * * other educational and training arrangements, including seagoing service and shipboard organization * * * at least equivalent to the requirements of this convention."

I recommended this action on an urgent basis because shifting from our current program of 6 months at sea to a period of 12 months at sea would seriously disrupt our 4-year, 11 months per year curriculum. The obvious adaption would be to extend the required sea training period at the academy by 6 months. This action would cause serious problems, as you can imagine. In addition, should the academy be forced to double the annual steaming time of the training vessels, we would incur an immediate additional fuel oil expense, an ineffective and unnecessary use of valuable energy, among other expenses, at today's prices of $352,000, plus the strong probability this would require an increase in our State budget at a time when our State director of finance has publicly stated that there will be no additional funds to meet even the inevitable inflationary increases. I am sure that the other State academies would find the additional cost equally prohibitive.

We have considered the alternative of placing our midshipmen aboard U.S. merchant vessels for additional sea training, but such

an action would conflict directly with the U.S. Merchant Marine Academy's requirements. We do not see anywhere near the required number of spaces available.

In today's highly technical and increasingly more sophisticated maritime environment, training aboard a school ship is much more efficient, effective, and possibly less costly than observer training on commercial ships. This is true primarily because training is more intensive and extensive under the close instruction of faculty. A variety of exercises are carried out on a training ship that cannot be performed on a commercial ship. There is practical, hands-on instruction because the ship is operated, maintained, and repaired by the cadets both during the cruise and when the ship is tied up on campus. Cadets perform progressively every job from seaman to watch officer on the bridge, and a similar progression exists in engineering. Senior cadets serve as the ship's officers. They help to train the underclassmen; they organize and manage all shipboard maintenance and repair; they carry out evolutions and drills; control ship maneuvers in and out of ports, at anchorages, and at sea. In addition, they must prepare all specifications for repairs and maintenance, and they are in charge of watches and daily shipboard evolutions.

In short, a training ship routine is dedicated to training cadets in every conceivable ship's operations and emergency procedure and doing each task on a repetitive basis. There is no real comparison, day for day, between the training onboard a school ship and the observer training aboard a commercial ship.

Survival at sea alone is scarcely the most important and probably the least efficient ingredient in the training of a third mate. Rather, it is the quality, type, and intensity of the training received that are the important ingredients.

The value of this program of sea instruction onboard school ships has been recognized for a hundred years.

Simulators today are playing a very important and ever-increasing role in training, and the use of these computerized training aids should be taken into account in any consideration of training equivalent to seatime. For example, completion of liquid cargo courses in which a tanker simulator is used provide a far better quality of training in overall tanker safety cargo handling procedures than would be available by using an actual tanker. Even if this training were feasible financially, there is always serious danger of polluting accidents, shipboard fires, or explosions in training situations on vessels—much too risky to make shipboard training practical. Similarly, the extensive use of a radar simulator provides far more variety in training than actual shipboard experience. Both the number and complexity of situations can be arranged to demonstrate a great variety of potentially dangerous situations as well as normal shipping traffic.

In view of the rapidly advancing technology in computers and simulator training, it is my view that simulation training in 10 to 12 years, I emphasize 10 to 12 years, will be capable of taking over the bulk of practical operational training, and thus in my opinion will reduce considerably the time required to be spent on inefficient and relatively expensive operational shipboard training.

At the California Maritime Academy simulators in laboratories already play a major role in our practical operational training.

There are today too many areas where on-the-job training simply is not feasible or possible, due to the potential risk or the expense, and we must turn to computer teaching aides to achieve hands-on operational training.

In my opinion simulators are an absolute necessity for more effective training, and I say more effective training to supplement what we have today for all tanker operations, like wide natural gas carriers and ship-handling operations for ships, where in real practice an error, miscalculation, or hesitation could spell disaster.

Computer simulators are a fast effective way to give students and licensed ship officers hands-on operational experience.

When I speak about simulators we are talking about operational experience in ship handling, bridge operations, engine room operations, cargo handling, where shipboard training might prove impractical, expensive, or dangerous, simulators can be used to instruct trainees safely and efficiently in operations and emergency procedures.

The maritime industry today in my opinion is far behind present technical capability in this area of training, and we should be trying desperatly to catch up.

The Maritime Administration is currently advocating the need for ship-handling simulators, bridge simulators at maritime academies and I believe these simulators would serve as an equivalent for some portion of the increased sea time requirement.

Certainly there is an urgent need for a simulator on the west coast, where no such facility exists. The installation of one of these simulators on our campus would have a significant impact on our training procedures and our ship operations. However, it would also serve as an advanced training facility available to the entire west coast shipping industry.

With a full range of modern simulators in operation, actual ship training time at sea could be reduced to an absolute minimum.

It's my considered opinion that the additional IMCO training requirements can best be met by the primary use of simulators and the continued extensive use of the training ship as a laboratory, as I have mentioned above.

This combination will provide the hands-on experience of a ship at sea plus the experience of operating and maintaining actual ship systems. There are a number of reasons why we must place more emphasis on simulation in maritime training.

Sea training is becoming very expensive, primarily because of the escalating fuel costs, but also because of the inherently inefficient employment of time at sea, of manpower, energy in the ship, which is a major resource.

Simulators will speed up the training process. Emergencies can be simulated which will seldom be encountered in a lifetime at sea. Case studies of past accidents and disasters can be recreated and studied on a simulator.

A simulator can create unsafe conditions that could not be duplicated in actual shipboard operation. Every conceivable accident or possible failure can be accomplished more safely, more efficiently, and in much shorter time on a simulator than on a training ship.

Simulation training turns out better officers because they learn by their mistakes on a simulator. Furthermore, simulators provide months of experience in a matter of hours.

For example, one veteran tanker skipper stated that he had acquired more experience and learned more in a week's training in our tanker simulator than he had learned from a full year's time at sea, and I am getting this from other skippers who are going through the course.

I think we would be wasting valuable time, energy, and resources if we tried to improve standards by lengthening the time at sea only. This is not the way to improve standards. There are better ways. No ship afloat can safely and economically perform all the emergency operations required for improving our standards of training.

With the rapid advances that are being made in computer technology and simulation technology, it's my conservative statement that within 10 or 15 years highly sophisticated simulators, and I am talking about 10 or 15 years, will be taking over the bulk of operational, and I underscore operational, shipboard training.

This simulator capability for operational training can reduce considerably the amount of time now spent on shipboard training. I would estimate that for cadets at State maritime academies—if we have this—in 10, 15, maybe 20 years, but in the future you could send them aboard a commercial ship. Only 3 to 4 months aboard a commercial ship at the most would be sufficient to supplement the time spent training on the simulators.

The training ship program at sea as utilized today by the State academies at that time with those types of simulators could be eliminated. Our present training ships could be maintained on campus as live laboratories at the pier, which could be activated in an emergency for use by the Federal Government.

By that time, the operation of training school ships at sea will have become excessively expensive in manpower, energy, resources, and more limited in their scope.

I propose to you today that the most effective and least expensive program in the short range for improving merchant marine officer training all around and merchant marine officer testing is to provide each training institution ship handling simulators, radar simulators, tanker simulators for the improvement of deck officer training and steam and diesel engine room simulators for the improvement of engineering officer training.

In 10 to 15 years, simulator technology probably will have developed a completely simulated ship, and we could integrate into one complete unit all these shipboard simulators. I am talking about 10 to 15 years, hence. I think that is a conservative statement.

A corollary to this would be an active program of dockside shipboard laboratory training on campus for cadet deck and engine training.

The problem of meeting the new IMCO requirements should be resolved by means of establishing simulator and dockside training described above with the use of a combination of small craft and laboratory aboard ship integrated into the curriculum while on campus, as I explained before, as equivalent to the additional 6 months of training by IMCO.

The alternatives, as I see them, are both expensive, inefficient, and relatively ineffective. The great versatility of this training facility also should be used much more extensively by the U.S. Coast Guard for testing proficiency and professional knowledge to improve the quality and effectiveness of license examination. I would like to thank the members of the committee for the opportunity to pass on these views.

Mr. PANSHIN. Admiral, your statement will be included in its entirety in the record of the subcommittee.

[The statement follows:]

PREPARED STATEMENT OF REAR ADM. JOSEPH P. RIZZA, USMS, PRESIDENT OF THE CALIFORNIA MARITIME ACADEMY

Mr. Chairman, Distinguished Members of the House Ad Hoc Select Subcommittee on Maritime Education and Training, and Ladies and Gentlemen.

For almost two years we at California Maritime Academy have been studying the revised standards of sea training as proposed by the International Convention on Standards of Certification, Training and Watchkeeping of Seafarers (1978), International Maritime Consultative Organization (IMCO). The objectives of our institutions are focused clearly on producing the highest quality officer for the U.S. Merchant Marine. We take this legislative mandate seriously; consequently, we are looking at the best and most efficient method of providing the practical training for merchant marine officers. This training must give them confidence in their ability to handle emergencies at sea and in port and the detailed knowledge and the specific skills required to carry out all their responsibilities rapidly and efficiently. I think that it is fair to say that the cost of this training, while of great concern to us, was not the primary factor in developing the recommendations which I will offer today for your consideration. At the California Maritime Academy we have been developing an increasingly varied spectrum of vessels, operational laboratory equipment and simulation systems to meet this need in the most efficient and effective way. Our midshipmen, during three years of their four-year program at the Academy, are on campus each year for two semesters and at sea for one semester on the Training Ship GOLDEN BEAR, a 10,000-ton former cargo passenger ship DEL ORLEANS, converted to a Navy attack transport during World War II and in 1971 provided to the California Maritime Academy by the U.S. Maritime Administration. The first year at the Academy students are put through three intensive semesters on campus in preparation for their first deep-sea cruise.

The most important point which I should make is that in the course of four years at the Academy, the nine semesters spent on campus consist of a daily routine which is best characterized as spent a half day in the classroom and half day in our shoreside laboratories, on our training ship engaged in practical work, on our smaller diesel towing vessels, and in our simulation laboratories. This routine is the daily learning experience provided to our midshipmen on campus for roughly eight months out of each year. It is a routine that is packed intensively with the practical skill training required to produce the finest deck officer and the finest marine engineer. I make this point first so that you will better comprehend that we rely only partially upon our current program of six months of seatime on the training ship to provide a practical foundation of seamanship, navigation and engineering skills for our graduates.

Now let me describe briefly the proposed IMCO standards for sea training which this Subcommittee is considering today. We have no quarrel with the proposed regulation for marine engineering officers, so I will focus on the proposed IMCO sea training requirements for Deck Officers. Regulation II/4, paragraphs 2 and 2(c), state in part:

"2. Every candidate for certification shall: • • •

(c) have approved sea-going service in the deck department of not less than three years which shall include at least six months of bridge watchkeeping duties under the supervision of a qualified officer; however, an Administration may allow the substitution of a period of special training for not more than two years of this approved sea-going service, provided the Administration is satisfied that such training is at least equivalent in value to the period of sea-going service it replaces; • • •"

The basic qualification in this paragraph, in my opinion, provides adequate international experience standards for a seaman applying for a Deck Officer's License (coming up the hawsepipe). The candidates must serve at least one year at sea.

However, the qualifying language does not provide for Deck graduates of the State Maritime Academies who receive a total of six months intensive training at sea under the strictly supervised, precise regimen of the nautical training vessel whose primary and only mission is training.

The lack of consideration in these regulations for our program of sea training probably was not a deliberate oversight by the U.S. delegation to the conference. The State Academies simply were not represented, nor were we consulted in advance. This omission is particularly unfortunate as the State Academies represent over 400 years of continuous experience in the education and training of U.S. Merchant Marine officers. Indeed, the bulk of the licensed officers afloat and ashore in the U.S. maritime industry today are graduates of these venerable maritime institutions. The State Maritime Academies have a well-proven system of officer training that is evidenced by the excellence of their product.

Since the IMCO Convention already has been agreed to by its international parties, the State Maritime Academies have recommended through the U.S. Maritime Administration that the U.S. Coast Guard take immediate action to provide for the licensing of Deck graduates of the State Maritime Academies. This action would be taken by the U.S. Government under the provisions of Article IX of the Convention, "Equivalents," which provides in paragraph (1) for "* * * other educational and training arrangements, including sea-going service and shipboard organization * * * at least equivalent to the requirements of this Convention." Paragraph (2) of this Article further provides that "Details of such arrangements shall be reported as early as practicable to the Secretary-General who shall circulate such particulars to all Parties."

I have recommended this action on an urgent basis because shifting from our current program of six months at sea to a period of twelve months at sea would very seriously disrupt our four-year, eleven-months-per-year curriculum. The obvious adaption would be to extend the required period at the Academy by six months. This would cause serious problems for our students, as you can imagine. In addition, should the Academy be forced to double the annual steaming time of the training vessels, we would incur an immediate additional fuel oil expense, among other expenses, at today's prices of $352,000. This would require an increase of over 10 percent in our State Budget at a time when our State Director of Finance has publicly stated that there will be no additional funds to meet even the inevitable inflationary increases. I am sure that the other State Academies would find the additional cost equally prohibitive.

We have considered the alternative of placing our midshipmen aboard U.S. merchant vessels for additional sea training, but such an action would conflict directly with the U.S. Merchant Marine Academy's requirements. We do not see anywhere near the required number of spaces. The U.S. Maritime Administration manages these cadet spaces on U.S. merchant ships, and I am sure that they are prepared to provide you with additional information.

We believe that the use of commercial vessels for training has some value because it places cadets in an actual working environment in various types of commercial vessels. Consequently, we encourage our midshipmen to make short cruises on commercial ships during their vacations in order to gain familiarity with a variety of ship types; i.e., bulk, container, tanker, etc., and with different control and engineering plants. However, I feel that for best overall structured training direction, the State Maritime Academy-operated training ship, in conjunction with smaller training vessels, practical laboratory aboard the training ship on campus, and the simulators, offers a far superior training resource. Embarking midshipmen only in operating merchant vessels as apprentices is insufficient and impractical in modern times, since officers, even if they were qualified instructors, are too busy with their normal duties to supervise extensively the practical training of cadets.

In today's highly technical and increasingly more sophisticated maritime environment, training aboard a schoolship is much more efficient, effective and possibly less costly than observer training on commercial ships. This is true primarily because training is more intensive and more extensive under close instruction of faculty. A variety of exercises are carried out on a training ship that cannot be performed on a commercial ship. There is practical, hands-on instruction because the ship is operated, maintained and repaired by the cadets both during the cruise and when the ship is tied up on campus. Cadets perform progressively every job from seaman to watch officer on the bridge and a similar progression exists in engineering. Senior cadets serve as the ship's officers. They help to train the underclassmen; they organize and manage all shipboard maintenance and repair; they carry out evolutions and drills; control ship maneuvers in and out of ports, at anchorages and at sea. In addition, they must prepare all specifications for repairs and maintenance and they are in charge of watches and daily shipboard evolutions.

In short, a training ship routine is dedicated to training cadets in every conceivable ship's operations and emergency procedure and doing each task on a repetitive basis. There is no real comparison, day for day, between the training on board a schoolship and the observer training aboard a commercial ship. For this reason, six months training at sea on a training ship has always been considered by the U.S. Coast Guard to be the equivalent to the one year of training as a cadet observer aboard commercial ships as is the practice at Kings Point. There is no evidence to substantiate a change in this policy today. In fact the evidence supports the superiority of the training ship program in establishing and maintaining high standards of performance. Let me elaborate a bit.

First off, survival time at sea alone is scarcely the most important and probably the least efficient ingredient in the training of a Third Mate. Rather, it is the quality, type and intensity of the training received that are the important ingredients. The Proceedings of the Maritime Safety Council and statistical data on maritime casualties point the finger of responsibility toward officers with many years at sea, not our young schoolship-trained Third Mates. Time spent on the high seas on routine watches is not the only nor the best crucible for the molding of a watch officer. Merchant ships simply do not perform training exercises, casualty control exercises, or maneuvers for the benefit of officers or cadets aboard. Nor does the routine of the daily watch on board a merchant ship dedicated to its commercial mission provide an effective training mechanism.

At the California Maritime Academy annual cruises are made each year during the winter months from January to the end of March. The average length of these sea-training periods is 12 weeks. In the course of our four-year curriculum each midshipman makes a minimum of three cruises so that a total of 36 weeks sea training time in cruise status is accrued. It should be noted that this seatime actually exceeds current U.S. Coast Guard licensing requirements.

Aboard a schoolship there is a 24-hour-per-day program dedicated to training and instruction, all under the critical eyes of competent licensed instructors. In the course of each of three annual cruises on our training vessel, the cadet moves through the ratings from seaman to watch stander. This training provided at sea includes a preliminary two-week period of intensive underway shakedown training and later during the training period another one-week period of intensive advanced underway training. This training consists of the following type evolutions, among others, conducted on a daily basis:

Emergency fire and boat drills,
Man overboard,
Williamson turns,
Radar navigation,
Engine maneuvering,
Engineroom casualty drills,
Lighting off and securing boilers,
Engine changeover from maneuvering to cruising and vice versa,
Rubber docking,
Anchoring and getting underway,
Towing,
Deck damage control drills.

The long ocean legs are filled with a daily routine of supervised watch standing, emergency drills, and a full schedule of professional instruction. The value of this program of sea instruction on board schoolships has been recognized for a hundred years. The synergistic effect of this practical learning experience is worth many times the equivalent amount of time spent in routine watches on board commercial ships on the open sea. It should be clear that the training experiences cadets are exposed to on a school ship dedicated to training far exceed those situations arising during the same period of time on board a conventional commercial vessel dedicated to trade so that, in effect, the school ship training cruise provides at least double the training opportunity that can be offered on a commercial vessel.

First Class (Senior) cadets on their final cruise serve as the watch officers with a licensed faculty member in the background for safety purposes. Other cadet responsibilities include the operation and maintenance of the vessel and its power plant repairs when necessary, and the supervision and training of lower classmen. All evolutions are performed under the alert supervision and evaluation of a licensed watch officer.

In addition to scheduled annual cruises, other valuable afloat and ashore training is conducted. For example, midshipmen voluntarily and at their own expense ride selected commercial vessels when available during their vacation periods to gain a different sea-going experience in a specific type vessel. Additional sea time is obtained on short cruises of two or three days aboard a variety of commercial vessels

during periods of academic recess. In addition, all cadets must complete a course in shipboard firefighting and damage control which culminates in a practical exercise conducted at U.S. Navy facilities. In our shoreside training, simulators are now being utilized to the fullest extent so that a wide range of practical, safe operational training not otherwise available or possible on commercial vessels is offered.

Currently a computerized tanker cargo simulator is in use at the California Maritime Academy. This training aid provides invaluable training in liquid cargo handling. Real time training is accelerated; emergencies of every conceivable nature confront the student cargo officer. Similarly, our Radar Simulator Laboratory is being used to maximum advantage for collision avoidance training and to a lesser extent for navigation and ship handling training. Aboard our training ship, the latest collision avoidance and satellite navigation equipment has been installed for training cruise. An ultra-modern sewage disposal plant has been installed for operational training and the practical prevention of pollution.

Extensive shipboard laboratory periods are scheduled during the two trimesters tha the training ship is moored at the Campus. During this time, both Deck and Engineering cadets perform weekly four-hour practical maintenance sessions. Additionally, during one trimester, senior Deck cadets engage in practical ship handling classes for four hours afloat each week aboard the Academy tug boat type training craft. As I pointed out before, practical ship handling experience for cadets, as well as the ship's own junior officers, rarely is possible aboard commercial vessels.

The total time spent in commercial ship riding and training ship practical laboratory periods amounts to at least one month per year so that, in the four-year period, four months of equivalent additional shipboard training is gained by these means, providing a total of 11 months actual training on board ship in our current four-year program.

As noted above, simulators today are playing a very important and ever-increasing role in training, and the use of these computerized training aids should be taken into account in any consideration of training equivalent to sea time. Completion of liquid cargo courses in which a tanker simulator is used provides far better quality of training in overall tanker safety handling procedures than would be available by using an actual tanker. Even if this training were feasible financially, there is always serious danger of polluting accidents, shipboard fires or explosions in training situations on vessels—much too risky to make shipboard training practical. Similarly, the extensive use of a radar simulator provides far more variety in training than actual shipboard experience. Both the number and complexity of situations can be arranged to demonstrate a great variety of potentially dangerous situations as well as normal shipping traffic. The Federal Communications Commission credits airline pilots with flight credit for time spent on aircraft simulators. It appears that pilotage time, for instance, could and should be allowed some credit for time spent on a bridge shiphandling simulator for a particular port. Likewise, some credit for operational time should be extended for training time spent on radar and tanker simulators as well as other operational simulators as they are developed.

All of the general information on professional qualifications cited previously for our Deck cadets applies equally to our Engineering cadets. Our cadets also receive practical experience which is not normally available to cadets on commercial vessels. A number of these experiences also include Deck cadet participation. This includes participation in the annual Coast Guard inspection and certification of the training vessel; participation in the quadrennial (four-year) American Bureau of Shipping special surveys for hull and machinery with most of the work done by cadets; participation in the quadrennial (four-year) opening of boiler mountings and the octennial (eight-year) mounting removal inspections with the work being done by cadets; participation in the annual drydocking overhaul of the training vessel; and participation in the daily preventive maintenance and repair of the training vessel during the two annual academic trimesters at the Academy.

A careful evaluation of the training opportunities afforded to cadets at this Academy will show a sea training "equivalency" for both Deck and Engineering cadets in excess of the one year spent by a cadet aboard a commercial vessel at sea. The combination of the annual training ship cruises, the short commercial cruises, the dockside training ship laboratory periods, the intensive use of smaller training vessels available to the Academy, and the extensive use of operational simulators, without doubt, should provide practical training equivalent to well over a year of sea training aboard a commercial vessel.

In view of the rapidly advancing technology in computers and simulation training, it is my view that simulation training in 10 to 12 years will be capable of taking over the bulk of practical operational training and thus will reduce considerably the time required to be spent on inefficient and relatively expensive operational shipboard training. At the California Maritime Academy simulators and laboratories

already play a major role in our practical operational training. Our simulation provides practical training in the basic theory of radar and the adjustment and operation of the radar set. Our primary course teaches radar plotting for basic rules of the road, collision avoidance and navigation to enable the student to qualify for the Coast Guard certification of "Radar Observer." However, we use the simulator for a variety of other training roles;

Third Class (Sophomore)—Use the coastline generator of the radar simulator for six hours practical work in conjunction with classroom instruction in navigation piloting.

Second Class (Junior)—In the fall, continue training in radar navigation for six hours; nine hours of instruction in classroom and simulator on basic principles of deriving information from radar presentations and relative motion and determining courses of action to avoid collisions. In the spring, we provide six hours of training on rapid radar plotting and basic problems of collision avoidance.

First Class (Senior)—In the fall our midshipmen take a minimum of 45 hours to qualify for Radar Certification including theory, operation of equipment, collision avoidance, radar navigation, and operation and principles of Electronic Relative Motion Analyzers. During the annual training cruise, the First and Second Class midshipmen undergo intensive training in all phases of radar navigation and collision avoidance, since the training ship deliberately is taken into high-density shipping lanes whenever possible.

Our Tanker Simulator Laboratory simulates a 70,000 DWT tanker. All First Class (Senior) Deck midshipmen are required to complete a course in tanker operations. As part of this course, a laboratory period is conducted on a trimester basis and each midshipman spends a minimum of 18 hours acquiring skills in loading, discharging and emergency procedures. Real time stress and trim calculation simulation is provided and antipollution measures are stressed. The simulator provides repetitive and realistic emergency situations in all areas of liquid cargo operations. By the time the midshipman has completed the course, he has had to cope with a myriad of crisis situations. Eventually we hope to incorporate a crude oil washing system into the simulator. In one week the students learn more about oil transfer operations than they would in a year aboard a tanker.

Our Diesel Laboratory provides a full trimester laboratory course in which the engineering student is trained to operate and maintain an operational marine diesel engine designed to simulate a direct-drive propulsion system. During the laboratory sequence, our midshipmen perform routine maintenance on the engine including dissassembly, inspection, reassembly and timing of a cylinder. They also are trained in the use of electronic analyzing equipment. The laboratory time is 12 hours per week for a period of four weeks.

Our Welding Laboratory provides experience in welding, brazing and burning techniques sufficient to effect emergency repairs on machinery at sea. The laboratory time is twelve hours per week over a period of four weeks.

In addition to our formal campus laboratory periods, practical hands-on shipboard seamanship and engineering laboratory sessions are conducted aboard the training ship at the pier between annual cruises to provide technical training and to practice management skills. All shipboard maintenance is accomplished by midshipmen between training cruises. Modifications and alterations within the capability of the ship's force also are accomplished by midshipmen. Each midshipman engaged in this laboratory spends three hours per day, four days per week aboard ship in a highly organized program.

The warrant officer artisans and the Senior midshipmen organize and supervise the work as laid out by the Chief Mate and First Assistant Engineer. The Junior midshipmen are assigned the skilled work of the Able Bodied Seaman/Oiler and Deck Engineers, and the Sophomore and Freshmen midshipmen carry out basic seamanship and engineering tasks.

Looking to the future, I see an ever-increasing role for the simulator in all aspects of maritime training. We hope to acquire a Low-Speed Diesel Marine Engineroom Simulator which will be a "first" in maritime training here in the United States. This modern simulator will meet the growing demand for advanced operational training for Marine Diesel Engineers. The rapid trend to marine diesel engines has been generated by the rapid rise in the price of fuel oil. The thirty percent savings in annual fuel oil costs generated by these large diesel engines provides the incentive of multi-million dollar annual savings to our shipping companies. An increasing number of American shipping companies have seen fit to convert existing vessels to diesel. Our obligation is to provide the trained engineers. A diesel engine simulation laboratory will contribute very significantly to this critical diesel training requirement.

For many years, aviation pilots have trained on computer driven simulators with complete pilot controls and mock-up cockpits, and FAA licensing authorities have recognized simulators as an intrinsic part of pilot training. The nuclear power industry has turned to computer simulation of nuclear plant control rooms for training plant operators. Unfortunately, we in the maritime industry have adopted simulator training too slowly, even though the way has been prepared by the acceptance of radar simulation in the training and certification of personnel as qualified Radar Observers. The use of simulators for LNG training prior to employment on a gas carrier and the acceptance by the USCG of certificates of satisfactory course completion are encouraging and indicative of the role that simulators will play in the years immediately ahead.

There are today too many areas where on-the-job training simply is not feasible or possible due to the potential risks or the expense, and we must turn to computer teaching aids to achieve hands-on operational training. In my opinion, simulators are an absolute necessity for more effective training for all tanker operations, liquified natural gas carriers and in shiphandling operations for large or very large crude carriers where in real practice, an error, miscalculation or hesitation will spell disaster. For years, simulators have been utilized by the U.S. Navy for naval team and joint ship training at very substantial savings in time and fuel to provide increased proficiency for operational personnel. I believe that it has been demonstrated clearly that computer/simulator training provides a realistic, effective and high quality means of training.

The maritime industry is far behind present technical capability in this area of training, and we should be trying desperately to catch up. The Maritime Administration currently is advocating the need for shiphandling simulators at maritime academies and I believe that these simulators would serve as an equivalent for a substantial portion of the increased sea time requirement. Certainly there is an urgent need for such a simulator on the West Coast where no such facility now exists. The installation of one of these simulators on our campus would have a significant impact on our training procedures and ship operations. However, it also would serve as an advanced training facility available to the entire West Coast shipping industry. With a full range of modern simulators in operation, actual ship training time at sea could be cut to an absolute minimum.

The U.S. Coast Guard awards the Radar Observer Certification on successful completion of an approved simulator course. USCG certification in other areas such as tanker operations, tanker requalification, piloting and certain aspects of engineroom operation, both diesel and steam, now is possible. To supplement written examinations appropriate portions of USCG examinations on rules of the road, radar, tanker, engineering or shiphandling operations and casualties of all types should be based on the applicant's operational performance on a simulator. In general, a tightening and significant improvement in standards could be achieved at less expense with the increased use of simulators now available. We have the technology to develop such a computerized simulation capability. Probably a completely integrated single ship simulator for all aspects of shipboard training should be developed.

It is my considered opinion that the additional IMCO sea training requirements can best be met by the primary use of simulators and our continued extensive use of the training ship as a laboratory. This combination will provide the hands-on experience of a ship at sea plus the experience of operating and maintaining actual ships' systems. There are a number of reasons why we must place more emphasis on simulation in maritime training. First, sea training is becoming very expensive, primarily because of escalating fuel costs but also because of the inherently inefficient employment of time at sea, of manpower and of the ship, a major resource.

The other cost inefficiencies of sea training center around the large, unavoidable expenses associated with operating an old ship modified for training. As you gentlemen are aware, drydocking and major periodic maintenance and safety requirements are quite expensive. However, the cost of replacing these old training ships with new construction training ships would be exorbitant, so we do need to develop a healthy set of alternatives, and simulation is our best prospect.

Considering the rapid advances being made in computer simulation and looking ahead only ten or fifteen years, I would predict that most maritime training and testing will be accomplished on simulators. The increased use of computerized simulators will produce a significant improvement in professional performance standards. The most significant aspect will be the improvement in safety and reduction in marine casualties and environmental pollution. These accidents are mainly caused by human error, and extensive use of simulators for training will reduce these casualties sharply. The prevention of just one marine casualty will pay for a number of training simulators. We can program an infinite variety of situa-

tions which will gradually, if not corrected, produce a casualty. We also can program situations where only an instant, correct response will avoid a casualty. Simulators build confidence in dealing with daily operations and a wide range of emergencies. Only a lifetime at sea could produce equivalent training.

Computer simulation can create any condition of constricted passage and heavy traffic anywhere in the world and any condition of wind, wave, tide or storm at sea. Simulators will speed up the training process. Emergencies can be simulated which will seldom be encountered in a lifetime at sea. Case studies of past accidents and disasters can be recreated and studied on a simulator. A simulator can create unsafe conditions that could not be duplicated in actual shipboard operation. Every conceivable accident or possible failure can be accomplished more safely, more efficiently and in a shorter time on a simulator than on a training ship. Simulation training turns out better officers because they learn by their mistakes on the simulator. Simulators are valuable for training new officers and they are equally useful for training veteran officers on new equipment. Furthermore, simulators provide months of experience in a matter of hours. For example, one veteran tanker skipper stated that he had acquired more experience and learned more in a week's training on CMA's tanker simulator than he learned from a full year at sea on a tanker.

Simulators will also play an increasing role in weeding out officer candidates who are professionally or emotionally incompetent to serve as officers. They can create an atmosphere of stress and produce requirements for instant decisions that are invaluable to this selection process.

In my opinion there are no excuses for most of the accidents we are experiencing at sea. Human error or human failure to check equipment and follow prescribed operational procedures is invariably at the root of the problem. Required simulator qualification, in my judgment, will reduce greatly the number of accidents, save many precious lives, preserve valuable cargos and prevent the rapid spread of environmental pollution. The evidence of our need for a better, more effective training and a more effective training device is the dramatic fact that today over 75 percent of our shipboard accidents are acknowledged to have been caused by human error. With this mounting tide of statistics in front of us, the need is obvious and immediate action is required. Furthermore, I can assure you that the answer does not lie with the methods of the past. Stretching out the sea time required in the long, routine and boring watches at sea is not the answer. I can think of no more effective or immediate solution to our problem than immediate expansion of simulator certification in every aspect of shipboard training.

We will be wasting valuable time, energy, and resources if we try to improve standards by lengthening the time required at sea. No ship afloat can safely and economically perform all of the emergency operations required for improving our standards of training. The increasing cost of operating a ship at sea, the rapidly changing character of maritime technology, the sophistication of shipboard systems, the increasing value and the potentially dangerous nature of cargos carried, and the increasing congestion in the shipping lanes and the harbors all inhibit the future use of commercial ships for effective training.

Some of my colleagues still believe that "time at sea" on a commercial ship is the best training for an officer. From my personal experience, I cannot agree with the tenet that making long, straight wakes on the wide open spaces of the ocean is the best method of improving officer standards.

Let me reiterate, with the rapid advances being made in computer and simulation technology, it is my conservative estimate that within the next ten to fifteen years, highly sophisticated simulators will be taking over the bulk of shipboard training. This simulator capability available for training will have reduced considerably the need for the amount of time now spent on shipboard training. I would estimate that for cadets at State Martime Academies only two to three months aboard a commercial ship at the most would be sufficient to supplement the time spent training on the simulators ten to fifteen years from now. The training ship program at sea as utilized today by State Academies then could be eliminated. Our present training ships could be maintained on campus as laboratories at the pier which could be activated in an emergency for use by the Federal Government. In ten or twelve years the operation of a training school ship will have become excessively expensive in manpower, energy, resources and time. Prolonged training at sea will become increasingly more inefficient and increasingly more limited in scope due to the potential danger inherent in a training operation conducted in high density traffic.

I propose to you today that the most effective and the least expensive program in the short range for improving merchant marine officer training and testing is to provide for each training institution shiphandling simulators, radar simulators, and tanker simulators for the improvement of deck officer training and both steam and

diesel engineroom simulators for the improvement of engineer officer training. In ten to fifteen years simulator technology probably will have developed a completely simulated ship, integrating into one unit all shipboard simulation. Corollary to this would be an active program of dockside shipboard laboratory training for deck and engineering cadets on our campuses.

The problem of fleeting up to the IMCO requirements should be resolved by means of establishing simulator and dockside shipboard training as equivalent to the additional six months at sea training required by IMCO. The alternatives, as I see them, are expensive, inefficient and ineffective.

For the future, the role of simulators in maritime training must be expanded to provide a full spectrum of simulation for all important aspects of operational training. The great versatility of this training implement also should be used much more extensively by the U.S. Coast Guard for testing proficiency and professional knowledge.

I would like to thank the distinguished members of this Subcommittee for the opportunity to pass on my views on this important subject, and I stand ready for your questions.

Enclosure. Article in the California Coastal News, Vol. 3, No. 4 of Aug. 1980, subject: "CMA Tanker Simulator."

CMA Tanker Simulator

"A realistic practical approach to solving problems encountered in tanker operations."

"The ability to experiment without the chance of a spill."

"The hands-on work, the opportunity to do it alone, and the constructive comments on better ways to do things were extremely valuable to me as a Junior Officer."

These comments describe the California Maritime Academy's (CMA) Tanker Simulator Course, an unusual collaboration between industry, government, and academia to teach oil tanker officers safe and efficient techniques for oil transport. The program's emphasis is on safety and pollution control; most major air and water pollution problems occur during loading and off-loading operations.

The Tanker Simulator, similar in concept to those used by airlines to train pilots, consists of a classroom, console, and computer. From the console, which was actually built for a tanker, the operator can control the simulated flow of petroleum to and from the storage compartments. The computer simulates the operations and an array of gauges on the console register the effects on trim (fore and aft balance), heel (side to side balance), and stress on the imaginary 70,000 ton vessel.

Students range in experience from greenhorn midshipmen to tanker officers with years of shipload experience. In one week they learn more about oil transfer operations than they would in a year on board a tanker.

A typical assignment would be to simulate a tanker run from Alaska to Long Beach. The student must calculate how much oil to load and where to distribute it throughout the ship. Improper loading could place too much stress at some point, causing a structural member to fail and the vessel to break in two. That's the easy part. The catch is that the instructor can plug any data he wants into the system, such as an inflow valve sticking open. By the time the trainee has completed the course, he has had to cope with a myriad of crisis situations.

According to William Black, the project director, "Most oil spills are the result of human error, someone not noticing a valve failure, for example. Our students are taught that equipment will malfunction and to recognize the failure and deal with it. Unless the steps that must be taken to handle the problem are imprinted on the officer, chances are that when an emergency arises, he won't handle it correctly. The simulator gives the student a chance to live through an emergency and learn what steps to take."

So far, 100 midshipmen and nearly 70 licensed officers have gone through the program. For the midshipmen, the Tanker Simulator Course is part of their curriculum at the Academy. For officers, the Academy offers a week long course, once a month for junior officers, and once every two months for senior officers. Most of the trainees are sent from Chevron, Arco, and Exxon as part of their training for marine operations, but, as the reputation of the program spreads, the diversity of the students' backgrounds grows. Some students, such as an experienced cargo ship captain, are willing to pay the $600 tuition out of their own pockets for the Tanker Simulator Course. Of the five instructors, three work for oil companies, one is a retired Coast Guard Captain, and the other, Brian Law, is the project manager and an instructor at the Academy.

The Tanker Simulator, the only one of its kind in the world, was conceived in 1978 when Chevron bought equipment to automate the loading and off-loading operations for three of the tankers. Chevron canceled the modifications and donated some of the equipment to CMA, along with $10,000 to study the feasibility of adapting the equipment to a computer. When the go-ahead was received, Chevron and several other oil companies supplemented their earlier contributions with $65,000 to make the system operable. In 1979, the Coastal Commission awarded CMA a Coastal Energy Impact Program (CEIP) grant of nearly $50,000 for computer hardware and software to improve the speed of simulation and to add hull trim, heel, and stress programs to the simulator.

Currently CMA is applying to the Coastal Commission for another CEIP grant to modify the simulator to accommodate an Inert Gas System, a safety mechanism which the Coast Guard now requires on all tankers 20,000 dead weight tons (DWT) and up. (Oil tankers range in size from the 10,000 DWT Liberty Ships of World War II, to 500,000 DWT tankers which are too large for any port in the world.) In an inert gas system, burnt gas from the stack is recycled, cleaned, cooled, and then pumped into the ship's oil tanks. Because of the high oxygen content, the empty tanks are highly volatile. Sparks from stray static electricity have been known to cause catastrophic explosions. The recycled gas reduces the oxygen level in the tank to prevent an explosion—even if a lighted match were thrown into an empty tank.

Eventually, CMA hopes to incorporate a Crude Oil Washing System into the simulator, and to expand the course to accommodate foreign tanker officers. In a Crude Oil Washing System, oil is used to rinse the sludge-like crude oil residue out of the tanks, greatly reducing the chances of an explosion, loss of oil, and water pollution. Foreign tankers constitute much of our coastal tanker traffic, though are not always subject to the same rigid safety and water pollution regulations as domestic tankers. Experience with the simulator would indoctrinate foreign tanker officers to American pollution and safety regulations.

The CMA Tanker Simulator marks a positive step toward safeguarding the shipping industry and preventing damage to the environment from tanker operations, and shows that diverse interest groups can work together for a common good.

Mr. PANSHIN. Admiral Rodgers?

STATEMENT OF REAR ADM. E. A. RODGERS, USMS, SUPERINTENDENT, CASTINE, MAINE

Admiral RODGERS. Thank you.

Without trying to repeat what my good colleague, Admiral Rizza, included in his statement, I will agree with 99 percent, perhaps taking small exception to the value of simulators down the road 10 to 15 years.

I wouldn't want to disagree with him completely. There is no question in my mind that they will become increasingly important as time goes on, and it's certainly important at this time, so in my comments I will try to focus in on a couple of things, one on the training ship situation as we have it.

In the first place, I am firmly convinced that the training ships at the State maritime academies are by far the best form of training available. I think that the time on a training ship on a day-to-day basis is worth more than the so-called observer time on a commercial ship. On the other hand, they are both extremely valuable.

Maine Maritime Academy initiated a rather formal program back in 1968 in which we substitute one of our three basic 2-month cruise on commercial ships, and that has been extremely successful.

It helps us to reduce the number of students aboard the training ship, so we believe we can improve the quality of training. Students going out to the commercial ships gain a variety of experiences, not only gaining the practical experience of the real world but, at the same time, they are bringing back reports and experi-

ences that are good for our faculty and students. So I urge the combination of training ship and commercial ship time, and I think that the Maine Maritime Academy solution has proven to be probably as effective as can be.

With regard to our present training ships, without going into the problems similar to what we heard on Massachusetts Maritime, I think all of us experience from time to time difficulties with our training ships. Maine certainly had its share this year too.

Most of it I believe stems from the fact that the only time that we receive a training ship is when no one else wants it. It's pretty well worn out and old. It leaves something to be desired as far as modern equipment, and so forth but, over and above that, the single most important thing at the present time is the need for an infusion of money to modernize the present training ships.

We heard that there are not replacements available. The so-called design of the new training ship apparently is in limbo for lack of money at the present time. I certainly would recommend that some action be taken immediately to modernize these ships with a goal of at least a 10-year span, and I am talking of modernization, I mean much more money than has been put in in the past, such things as even changing the electrical system from DC to AC. That is just one single example, so that we could get on with present technology, and so forth.

I do think that we should be studying new training ships in spite of the fact that simulators are going to become increasingly important, and it may be that a new training ship of the future will have a number of these simulators aboard and combine both features.

There is no substitute for getting students out to sea in the real thing, and we should be more active in pursuing the design of new training ships.

I would like to invite your attention to part of my statement which I won't elaborate on now, but the Maine Maritime Academy did have the good fortune of being an official guest of the Soviet Minister of Merchant Marine in 1974.

We took our training ship to Leningrad. We were hosted by a Soviet training ship, and that particular ship incidentally was only 2 years old. There were three of that class that had been built for training, had duplicate engine rooms, duplicate bridges, pieces of equipment that were similar to the operating pieces that the students would actually take apart in a laboratory.

They also are designed to carry cargo and operate as part of a fleet, and they were extremely effective as far as training and experience for the students.

There are things that we can learn from the Russians. I would like to also mention that Maine Maritime Academy has used its training ship for promotion of trade, and the carrying of gift cargo to the underdeveloped nations. So what I am suggesting is that in the study and design of new training ships, we should try to look and see what else can a training ship do to do something for the country and use our tax money more effectively.

I think another aspect of what we need to do on training would be to encourage through some incentive commercial ship operators in building new ships, to provide a cadet bunk room aboard.

As we know, all subsidized ships are required to have space for two cadets, primarily the Kings Point cadet requirement, but it seems to me that a little more incentive to provide additional space would be very, very valuable. If other academies decide to use some of that type of seatime, why it would be available, whereas today there just aren't enough spaces aboard commercial ships for all of us to go the route that the Maine Maritime Academy has.

Getting on to beyond the training ships, with regard to simulators, I would like to start off by saying that I think the witnesses tend to underestimate the impact on the State academies of the IMCO seatime requirements. Such statements as the only ones that are going to be affected are the academies. Not only that but when you look at what the simulator is going to cost, what the housing for it is going to mean in terms of money and space, the manning and operating costs and the upkeep costs, I foresee very formidable financial problems. I don't have any good figures, but just jotting down some figures, the $3 million to $5 million for a simulator, and I would assume that it's going to cost a quarter of a million to put some kind of a structure around it, staffing and operating costs $100,000, and upkeep of at least $25,000 per year.

Those are probably too modest, but I only want to say before we go headlong into these things somebody does need to consider all of these various problems.

It's not only the cost factor, but there are time problems involved. For instance, at the present time we at the State maritime academies, and I am sure it's true at the Federal Academy, are really packing in about 5 years into a 4-year program through the 11 months and the seatime and the maintenance requirements on the ship and the watch standing, and so forth, and by adding these additional things, whether it's at sea aboard the ship or whether simulator time or whether it's small vessel time, these are additional time requirements, and they are not easy to solve, and I am not sure what is going to give.

I have a feeling, an uneasy feeling, that when it comes down to it that the thing that probably will have to give is some of the amount of time that we spend, that is the students spend in the maintenance and upkeep of our training ship.

As you heard from California, Maine is the same way, our students are there all year long, every day of the year with the exception of a weekend, and on a weekend they are standing watches, but there is an active group of maintenance students performing some tasks, working with the electricians, the engineers, and so forth. As we are pressed for more things, such as simulator time, something has to give and I wouldn't like to see the ship maintenance suffer because I think the State academies particularly by having the training ship maintained by students have earned an enviable reputation for hands-on practical type of seagoing people, which is extremely valuable.

I just think those things need to be said. With regard to the effectiveness of simulators in the program, both the small vessel as well as the electronic bridge simulators are extremely valuable. We all ought to have them. I think if I were sitting here with a Coast Guard hat on, I would even speak louder with regard to the value

of them, because I think in addition to just plain training on them, they are an extremely effective means of testing.

Having been a naval aviator and been through simulators, I know that before you really sit over in the left-hand seat and actually fly the airplane, you have a better opportunity to demonstrate through some performance on simulators your qualifications to handle these emergencies.

Today in our maritime training we don't do this very well. The Coast Guard administers a written examination, but there really isn't a means by which you can guarantee that every student who graduates and gets that license can handle these various situations when it comes down to the real life situation.

I think the simulator can approach that very well. We can't do it all with the ship.

Two other very short comments, responding to testimony we heard before, there was some statement asking about how other maritime nations were meeting this problem of the increased seatime, and a reference was made to the United Kingdom.

It's my understanding that in the United Kingdom, the students at the maritime academies are basically sponsored by shipping companies who in turn provide the sea experience aboard their own ships, and they get their year's seatime and they have been doing this.

Therefore, they are not under any particular pressure to get more seatime, and the simulator is looked upon as simply something to enhance the value of training.

Furthermore, the students there are being sponsored by the company, not subject to the costs that our State academies are. In the case of Maine, we have had to increase our fees 11 percent this coming year, 10 percent last year, and it's getting up to the point now where the total cost is well over $5,000 for many students, and it becomes a problem.

The other statement I would like to refer to, and Admiral Benkert very correctly said that we were given advance notice of the IMCO Convention meeting, and so forth.

The only thing is that we are talking basically about this increased seatime, and that was not in the draft. I personally reviewed that draft. I found nothing wrong with it. I couldn't find the time and money to go to London for a couple of months if there had been something in the draft suggested that there was going to be an increase in seatime, there is no question that we would have spoken up, so I think he is correct that we were aware of the convention, but not correct with regard to being aware of that particular increase in seatime.

Someone else mentioned this morning that that came up at the convention, and even though they had been meeting for some 8 years, in talking about these standards, within 2 days they resolved that particular issue and we had no input, and I think it's too bad that we didn't.

I think that pretty much summarizes the high points of the things I wanted to say, sir.

[Admiral Rodgers' statement follows:]

PREPARED STATEMENT BY REAR ADM. E. A. RODGERS, USMS, SUPERINTENDENT OF MAINE MARITIME ACADEMY

Mr. Chairman, Members of the Committee, I appreciate this opportunity to appear here today, to present my views on the problems the state academies face with their training ships. The ships are an integral and essential aspect of the program for the training of merchant marine officers at the several state academies. We are at a critical stage as we face the possibility of a doubled sea training requirement for deck officers with ships that are aging rapidly, and expensive to operate and with no visible replacements in sight. I trust that your current study and the awareness of our problems that you demonstrate by this hearing, may lead to a solution of our problems that will serve the national interest.

Since 1968 Maine Maritime Academy has used a combination of training ship and commercial ship sea time for all cadets. It has been formalized into our program such that all cadets spend two months on the training ship at the end of both the freshman and junior academic years and during the summer after their sophomore year they are assigned to various commercial vessels for at least two months. We developed this sytem in order to limit the number of students on the training ship to two classes for more effective training. Furthermore the one summer on a commercial vessel gives students an opportunity to experience the real world and gives the Academy on opportunity to draw upon the wide variety of student experiences. We have found this arrangement to be ideal.

Our training ship is truly a working laboratory during the entire year. Students are assigned maintenance and watch duties as a routine part of their daily program. During the course of four years all students spend a considerable amount of time working and standing watches on the ship and we believe that our good reputation in the industry is due largely to the heavy emphasis that we place on the use of the ship as a training laboratory.

Although we advocate a training ship for each academy, there are three major problems with the present ships. In the first place they are old and the government has not been providing sufficient funds for their upkeep. Secondly, they are not ideal training ships in that systems are obsolete and they are lacking in an opportunity for diesel engine propulsion training. Finally, training ship operating costs for the academies are very high. Now that provisions are being made for the government to provide fuel oil for cruises, and hopefully additional funds for ship upkeep, these problems will be relieved considerably. However, we are only buying time and it is not too early to start working on replacement training ships as the present ones have only about ten years of service life remaining.

Since there are no replacement vessels in service or in the reserve fleet and there aren't enough berthing spaces aboard U.S. flag operating vessels for all academy cadets, it should be obvious that time is running out for action. The ideal solution would be to construct new ships designed for training purposes, one for each academy. If this isn't feasible, then a system of rotating a couple of ships between the academies could be developed but this will present very serious problems in scheduling. The whole educational system in our country is geared to a fall and spring semester and there are times of the year when it would be very undesirable to be scheduled for a cruise. Also we would lose the ship as an alongside laboratory and thus our program would suffer. Furthermore this system would require a small nucleus crew to stay with the ship with a higher salary than at present. An alternative to training ships might be to require all US flag ships to provide a cadet bunkroom for six to eight cadets. Eventually this would provide sufficient berthing for all maritime cadets, federal and state, and thus eliminate the need for training ships.

I do not advocate this latter suggestion since it would not be as appealing as having our own ships, but it is mentioned because it does represent a possible solution that might be considered.

The foregoing comments are based upon the present requirement for six months sea time for state academy cadets. All indications are that graduates of the academies are performing very creditably so the cost in time and money of complying with the IMCO standards of training and watchkeeping for a doubling of this time for deck cadets does not appear to be justified. Actually certain types of simulator and small boat experience would be a far better utilization of resources as an equivalency for the additional six months sea training. It is difficult to state at this time how the IMCO standards will affect our policies and operations because we do not know how the Coast Guard will evaluate training ship time vs observer time on commercial ships, simulator and small boat time as part of the equivalency package. Regardless of how the requirement is met, it will be very costly and something in our programs will have to be eliminated in order to work any form of this additional training into the four year period. Most probably the extra time would have to

come from time presently devoted to ship's maintenance. My specific recommendations are:

1. Initiate immediately a major modernization program on all present training ships.

2. Provide a requirement or an incentive for ship operators to accommodate more cadets with berths aboard US flag and US owned foreign flag vessels (This is with the long range objective of having accommodations for one, two-to-three month cruise per year for all state academy cadets aboard a commerical ship. This would reduce the number of cadets aboard training ship cruises for better training and significantly reduce the requirements both in size and number for new training ships). As stated previously, we feel strongly that the combination of both training ship and commercial ship experience is the ideal to strive for.

3. Initiate a program to design and construct modern training ships to be shared by the State academies.

4. Initiate a program to provide each academy a ship handling simulator.

(Note.—Assuming that some sea time equivalency will be granted by the Coast Guard for small boat training, each academy should move to acquire a suitable vessel for this purpose. Maine Maritime Academy is proceeding with this project at the present time.)

Before racing headlong into the development of a new training ship, I propose an experiment utilizing one of the academies and its present training ship. The experiment would involve authorization and support for the use of the ship for other purposes of value to our country in addition to cadet training. Maine Maritime Academy has used its training ship on occasion with trade fair exhibits and activities aboard to promote Maine Products. If properly supported by industry and the Commerce Department, there is adequate space aboard these ships to set up a large scale trade fair that could visit ports of interest throughout the world in order to promote sales of U.S. products. At the same time the ship could be used as an instrument of good will in support of State Department objectives. Maine Maritime Academy has made two visits to South America with gift cargo in support of the PARTNERS of the AMERICAS Program. These visits were extremely successful in building better relations between countries. As a condition of the experiment I would propose one three month cruise per year for the next few years so that most ports in the world could be considered. Also this would provide some additional sea time to meet the IMCO requirements. If sufficient income could be derived from exhibit sponsors and a small percentage of sales, the experiment could prove to be a practical solution to the type and method of operating new construction training ships.

Another possible use for a training ship that appears to have national benefits would be to cooperate with the college semester at sea programs. This program is being conducted by the University of Colorado at Boulder using a foreign flag/foreign crew ship. Reportedly this arrangement is not satisfactory and Maine Maritime Academy has been approached for the use of our training ship. Federal regulations do not permit us to use the ship for such programs. It would appear that in the national education spectrum there should be an opportunity for some college students to spend a few months in study and travel aboard a US flag ship. If the Congress concurs in this objective and regulations were amended to permit cooperation with this program, the use of a maritime academy training ship could make the difference between survival or termination of the program. The time has come to be more imaginative and to use our government resources more constructively in pursuit of national objectives and good business practices. As a taxpayer, I object to having training ships cruise for training only, when with a little extra effort they could be used for additional purposes and enhance the practical education of students while still performing their primary mission.

In closing, I would like to pass on to the committee an observation from the visit of the Maine training ship to Leningrad in 1974. The Russians assigned a new specially designed training ship, the "Professor Ukhov" as our host ship and I had the opportunity to inspect the ship and talk to the maritime officials at all levels. Their training ships are designed primarily for training but they also carry cargo. In this particular case the ship was designed for refrigerated cargo. One feature of the ship's design that impressed us was a separate and nearly duplicate engine room that was used only as a training lab. The training ships were not operated solely and separately as training vessels but by the Baltic Ship Lines. When, as a gesture of courtesy, I extended an invitation for the "Professor Ukhov" to visit at the home of the Maine Maritime Academy, the Deputy Minister of Merchant Marine immediately responded with the statement "First we must talk cargos and trade, the ship does not cruise empty."

In the design of new training ships we should consider what else the ship might do, such as carry military or aid cargo, act as a trade fair ship and as an instrument of foreign policy in such activities as "people to people" programs.

Mr. PANSHIN. The comments both you and Admiral Rizza made on the IMCO convention are noted. As well you spoke to the problems of the training ships, and I wish to reassure you of this subcommittee's awareness of those problems and its efforts to obtain increased funding both for repair and maintenance and for renovation of existing ships.

At this time may we receive testimony from Commodore Hendy from Massachusetts.

STATEMENT OF COMMODORE WILLIAM R. HENDY, JR., ACTING PRESIDENT, MASSACHUSETTS MARITIME ACADEMY, ACCOMPANIED BY CAPT. GEOFFREY MOTTE, VICE PRESIDENT OF ACADEMIC AFFAIRS, BUZZARDS BAY, MASS.

Commodore HENDY. I assume my comments that I have forwarded will be put into the record.

I will just briefly summarize them by saying that the underlying philosophy upon which the Massachusetts Maritime Academy approaches the IMCO standards is based on the continued use of the training ship and future ship simulators such as full function training simulators, diesel engineroom training simulators, liquid loading simulators and damage control and firefighting simulators.

This would be of course in addition to the traditional knowledge that we expect our graduates to have.

I would also like to reiterate that in order to continue the training ship methods, a substantial commitment must be made to improve the operating status of the academy's training ships provided by the Maritime Administration.

Considerable effort is immediately required to bring these vessels into an even reasonable operating condition.

I would like to second my colleague's comments in full. I would also like to state that with me today I have the vice president for academic affairs, Dr. Geoffrey Motte, who is a master mariner. Dr. Motte also holds extra maritime papers and he is prepared to give the committee the benefit of his experience and knowledge, especially as it relates to simulators.

Thank you.

[Commodore Hendy's statement follows:]

PREPARED STATEMENT OF COMMODORE WILLIAM R. HENDY, JR., ACTING PRESIDENT, MASSACHUSETTS MARINE ACADEMY

Mr. Chairman and Members of the Ad Hoc Subcommittee, my name is William R. Hendy, Jr. I am here as Acting President of the Massachusetts Maritime Academy, a position which I was appointed to on August 19, 1980. I have been employed at the Academy since 1961 and have been Executive Vice President since 1972.

I should like to thank the Committee for this opportunity to represent the Academy and its graduates.

A detailed analysis of existing and proposed maritime training at the Massachusetts Maritime Academy together with associated arrangements for accumulating time at sea has been submitted to the Maritime Administration for preparation of the equivalency package. The underlying philosophy upon which the Academy's approach to the revised IMCO standards is based is as follows:

(a) The quality of seatraining afforded by the training ships operated by the State Academies is of the highest calibre. This fact is reflected in the excellent reputation held by officers of the U.S. Merchant Marine within the International Community of merchant seamen.

(b) Over the past decade substantial advances have been made in the application of various modern technology applications to everyday maritime industrial practice. Large ULCCs, Container Vessels and LNG carriers are the rule rather than the exception. Budgetary considerations render it extremely difficult for institutions that rely primarily on state funding to stay current with the expensive training simulators and laboratory equipment necessary to provide realistic education in this area of high techno' gy. Specific requirements are for:

(1) Full function ship training simulators.

(2) Diesel engineroom training simulators.

(3) Liquid loading simulators.

(4) Damage control and firefighting simulators.

(c) A critical national manpower requirement and considerations for the integrity of this nation's defense capabilities are presently affected directly by financial restrictions at both State and Federal levels. It is interesting to note that, in contrast to this situation, five full function ship simulators are expected to be operational for deck officer training at Maritime Colleges within the United Kingdom by the end of this year. Not one State Academy in the U.S. presently has, or expects within the next three years to have, a ship simulator designed to train officers in modern bridge practice.

(d) The traditional knowledge in seamanship, navigation, meteorology, ship stability construction and maintenance remain the cornerstones of a deck officer's initial training. Similarly diesel engineering, auxiliaries, mechanics, boilers and turbines are basic necessities for engineering officers. However, it is of paramount importance that a sound academic program be operated in conjunction with such practical training in order that it is possible for the technical material to be transmitted at a sound professional level.

In order for the State Maritime Academies to continue to respond to the nation's accelerated needs, (Marad Manpower Projections through 1990), an increasing financial burden must be borne by the Federal government in order to provide to the industry enlightened junior officers conversant with up-to-date industrial practice. A substantial commitment must be made to improve the operational status of the Academy Training Ships provided by the Maritime Administration. Considerable effort is immediately required to bring these vessels into even a reasonable operating condition. The training provided by these vessels is invaluable and proven over many years. This fact is well recognized in every way except the vital supply of necessary operating funds.

In summary this Academy expects to meet the new IMCO standards by an appropriate combination of increased training vessel experience, realistically simulated conditions in controlled instructional setting and traditional maritime education founded on sound academic preparation.

Thank you, Mr. Chairman, ladies and gentlemen, for your thoughtful attention and consideration.

Mr. PANSHIN. Thank you, Commodore. Your remarks in their entirety will be included in the official record.

Admiral Kinney of the New York Maritime.

STATEMENT OF REAR ADM. S. H. KINNEY, USN (RET.), PRESIDENT, STATE UNIVERSITY OF NEW YORK MARITIME COLLEGE, FORT SCHUYLER, N.Y.

Admiral KINNEY. Mr. Chairman, members of the committee, if New York Maritime College is confronted by Federal rulemaking with respect to STCW-II-4, that gives full effect to the IMCO seatime for mates, we face significant, perhaps impossible problems of first, cost and second, curriculum compression, if we are to remain a 4-year college.

The Council of American Master Mariners in speaking to this went on record to the effect: "* * * urge that the United States avoid precipitous action or premature unilateral implementation of standards that would place the American merchant marine and domestic maritime industries in a disadvantageous position."

The proposed IMCO rule, if adopted, would hurt the capability of Fort Schuyler to produce initial entry officers. The United States

need apologize to no nation nor to IMCO for the present licensing standards. There is no empirical evidence that the mates the current standards produce are incompetent.

The IMCO proposals are formulated by compromise among European and other national practices. Witness the divergent views of required seatime for deck and engine officers, a typical Royal Merchant Navy point of view.

The U.S. methods of education and training for the sea are far different from the European. If we mix apples and oranges in a training basket, we improve neither.

Implementation of the IMCO proposal is espoused in the United States by some based on two myths about seatime as it relates to license preparation.

First, that seatime is synonymous with training time; that is, just being afloat provides increased knowledge, competence, and professionalism. This is false.

Second, more seatime is better. The longer you spend afloat, the more competent you become; also false.

Blind acceptance of the IMCO-proposed regulations would subscribe to these myths. Somehow, it's imputed that more cadet seatime will reduce collisions, groundings, and pollution, but there is no evidence that these are being caused by entry-level officers who are school ship, that is State academy, graduates.

State University Maritime College is dedicated to training competent entry-level licensed officers, deck and engine. We have done so for 106 years. We welcome valid means of further improvement, but we doubt that the IMCO resolution necessarily achieves this.

There are other means such as training devices that can be beneficial, because they provide programmed and evaluated learning experiences in a controlled environment. Bridge operation simulators are among these. I use that term advisedly. Third mates are not ship handlers.

To summarize, SUNY Maritime College presently has 1,000 students. The fiscal condition of the State university as reflected by the fiscal condition of the State of New York will probably not support the costs of increased seatime, nor can New York afford to buy expensive simulators or the buildings to house them or to operate them.

The 4-year program of instruction would be seriously altered by a requirement to make room for 1 year of seatime. The result in our opinion would be to degrade, not to improve, the quality of the graduate as a seafarer.

The present requirements of seatime to be licensed by the Coast Guard are adequate, and in the United States we need apologize to no nation nor IMCO for the quality and capability of the third mates and third assistant engineers produced by every source in our Nation under the present requirements and standards.

Thank you for the opportunity to appear and testify.

[Admiral Kinney's statement follows:]

PREPARED STATEMENT OF REAR ADM. S. H. KINNEY, USN (RET.), PRESIDENT OF THE STATE UNIVERSITY OF NEW YORK MARITIME COLLEGE

I am Sheldon Kinney, President of the Maritime College of the State University of New York, located at Fort Schuyler, where the East River joins Long Island

Sound. The Maritime College appreciates the opportunity to appear before your Committee to testify on Sea Training at Maritime Academies.

This opportunity to present our College viewpoint on serious concerns in Maritime Education and Training is another step forward. This Committee has given the State Schools important opportunities to be heard on pending legislation and authorization, and, Mr. Chairman, the hearings have been, to us, constructive and collegial, about schools that are a unique national resource for economy and defense.

The hearings today are about Sea Training at the Maritime Academies. With regret, we concede there exists no comprehensive theoretical foundation for our understanding of maritime education and training. However, there is a long history and a considerable body of empirical evidence that can reveal the path to where we are, and the articles and artifacts of the state of the art. Lacking a comprehensive accepted theory, predictions can hardly be made with much certainty, or unanimity, but the history and the practice can help us testify to our expectations for improvement and where to go from here.

A vital influence in the history of maritime education and training was the vision of Admiral Stephen B. Luce of the U.S. Navy. In addition to his landmark achievements in Navy education and training, he initiated what I would say was the first most important step beyond pure apprenticeship of merchant seafarers "before the mast." He created the schoolship concept embodied in Congressional legislation in 1874.

The original concept deserves our attention for the scope of the principles established. These principles have withstood the test of time, over one hundred years, and through periods of dreadful challenge to the success of the merchant marine in national defense. The principles are not, to my knowledge, under direct challenge today. But some are definitely eroded and unfortunately close to dilution, and we could be stranded if we don't steer a proper course.

The legislation enabling Luce's concept was Federal. The committee's hearings on H.R. 5451 carry forward the Federal concern, as does this Hearing.

The Federal purpose included recognition of merchant marine training as a contribution to national defense. Luce knew that merchant seamen were, in wartime, a vital resource. The committee's H.R. 5451 hearings were mindful of this principle.

The legislation successfully introduced instruction in a Federal school ship alongthe Federal and State governments. The committee's initiative in authorizing appropriation for training cruise fuel costs was a recent affirmative of the partnership as seen on a cost basis, a basis on which one partner had in the State view become somewhat silent.

The legislation successfully introduced instruction in a Federal school hip alongside the dock and afloat with Federal instructors. This concept has mostly survived and is central to the Hearing today. The committee has been attentive to the idea heretofore, and we welcome the continued interest and the opportunity to speak out. Admiral Luce is said to have delivered the first authorized training ship himself, directly out of the Boston Naval Shipyard refit. We can't expect quite that, but the interest of this committee is certainly in the finest tradition.

Mr. Chairman, I hold that the basic tenet of Sea Training at Maritime Academies has the roots I've mentioned going back over one hundred years, and that there are clear storm warnings flying now, and that the Maritime College is very pleased by the interest of this committee in these matters and the invitation to present our views.

One of the clear storm warnings is due to the standards proposed by the International Convention on Standards of Certification, Training and Watchkeeping of Seafarers, 1978. A second is due to the status of schoolships.

We reviewed a comprehensive draft of the IMCO Standards prior to the June–July 1978 Convention, and there were no problems. In July 1978, the delegation returned and the first sign of a problem was the question: "How are you going to meet the new one-year sea time requirement?" Something happened there.

Evidently there may be various problems with the July 1978 Convention, as the Council of American Master Mariners is on record to ". . . urge that the United States avoid precipitous action or premature unilateral implementation of standards on U.S. vessels that would place the American merchant marine and domestic maritime industries in a disadvantageous position . . ." For our part, there is a distinct focus of irrationality, and that is the proposed standard for the entry-level licensed officer's prior sea experience and age.

The IMCO proposed Regulation II/4 for entry-level Deck Officers would require a minimum age of 18, and, for a graduate of a three-year training school, one year of sea time. Proposed Regulation III/4 for entry-level Engineer Officers would require

a minimum age of 18, and, for a graduate of a three-year training school, "an adequate period of sea service."

The Maritime College does not recommend implementation of regulations that would permit the Federal and State Academies to accept 15 year-olds that in three years would have completed a program with either one-year or "an adequate period" of sea time to be licensed entry-level officers in the U.S. Merchant Marine.

At the present time, the State School programs, having evolved over one hundred years since the principles established, admit graduates of secondary education schools, undergo a minimum of three years' education and training, and experience six months' intensive training under the supervision of licensed training officers before evaluation by examination for entry-level positions. This applies to both Deck and Engine Officers.

Mr. Chairman, we make no apologies whatsoever to IMCO, to any foreign nation, to anyone, for the basic structure of entry-level licensing in the United States.

We want to improve the efficiency and effectiveness of our program, but we hold steadfast to the principles established, and are deaf to the mythology and degradtion implicit in blind passive acceptance of IMCO as an expedient to meet the challenge of better training for a better merchant marine environment.

The IMCO proposals are dominated by compromise among European and other national practices. Witness the divergent views of required sea time for Deck and Engine Officers. We should improve our United States practice, but the improvement must be based on rational extension of our proved practice. We must expose the fact and the fiction, the truth and the myths surrounding sea training, sea time, and sea experience.

Mr. Chairman, I am satisfied that your invitation for testimony at this hearing exhibits the same interest to know, as best we can on empirical evidence, the truths and myths about sea training. The Maritime College is pleased to present its view.

Two examples each of truths and myths about sea training are these:

Truths	*Myths*
All seafarers need it	Sea Time is Sea Training
Seafarers need more than it alone	More is better

If you believe the myth that sea time is sea training, then you would believe that more is better. Blind acceptance of IMCO proposed regulations would be a typical behaviour pattern to exhibit subscription to those myths.

Somehow it is imputed that more cadet sea time will reduce collisons, groundings, and pollution events. The statistics, often quoted, that 80 percent marine casualties involve human error may be reasonably true, but no hint of statistic has shown that the human errors were by entry-level officers who were ill-trained cadets. Similarly, there seems to be a mythology that the pressures of public awareness of marine hazards or public dissatisfaction with the maritime safety record would be satisfied by increasing cadet sea time, since more is better and sea time is sea training. It just isn't so, because those are myths, and because our empirical evidence is that entry-level officers do not pilot ships, they do not maneuver ships in confined waters, they are not assigned shiphandling jobs, and that night order books left for junior mates invariably require, "In case of trouble, or an expected encounter, call me."

Sea time is not sea training for the simple reason that time is not transmuted invariably into a proper learning experience. That is, not all sea time has the same time-effectiveness of training. There is compelling empirical evidence that for entry-level officer training, the least time-effective is experience not supervised or critically evaluated by a training officer. The improvement in time-effectiveness is about three-to-one if the student officer is officially assigned as such, currently documented as a cadet observer, with a sea project to be completed, reviewed, and evaluated. Time-effectiveness is further improved about two-to-one by completing the sea time as Admiral Luce envisioned: under continuous supervision of qualified training officers excuting a training syllabus that is the at-sea complement to training ashore in a dedicated training ship.

This three-tier evaluation of time-effectiveness is, for example, evidenced in 46 U.S. Code and Section 310.3, Part 310, Merchant Marine Training, of General Order 87. It is known simply in the trade as sea time requirements for qualification to sit for examination to become an entry-level officer.

Until that fateful day in July 1978 when the IMCO delegations succumbed to mythology, I know of no founded assault on the practice established in the United States for evaluation of entry-level officer candidates. In particular there is no correlation with human error casualty statistics.

A profession is unique in part because its entry-ports are unique and not common experience. Doctors have it, lawyers have it, and the profession of Master Mariner

has it. All seafarers need sea training. Progressively senior positions need to have proved preparation and competence. The Maritime Academies are not experienced in providing sea training or other preparation beyond entry-level. New York is commenting only on entry-level.

For the entry-level, certainly, and most likely for more senior competence, seafarers need more than sea training.

What more? Study, and exercise on training devices.

Study comes before and after sea experience. The Rules of the Road must be known before another vessel is sighted, if the encounter is to be a true learning experience. "What if?" questions can be asked after some basic realities have become inherited, so intuition seeks the unpredicted but possible. Study guides, proprietary and union schools, and the academies all provide modes for this study. IMCO seems to trade off three years' sea time without specific study for two years' guided study and one year sea time, but there is no information on what must be studied.

Training devices are essential because they provide for programmed and evaluated learning experiences in a controlled environment. No one doubts the value of the simple blinker light trainer. Next, the typical ship light displays can be had by anything from flash cards to films to planetariums to whole bridge simulators. Further, an approved course in radar observer training must (46 U.S. Code) include "suitable training devices." And now of course technology can provide bridge operations simulators.

Shiphandling simulators, or as we prefer to use them, "Bridge Operations Simulators" have been made possible because the ship motion mathematical models are reasonably well understood, and because the equations are manageable on modern minicomputers, and the visual imagery is adequately convincing. The willing trainee is quickly immersed in the dynamics of the scenario, a controlled and evaluated learning experience. For the same reasons the blinker lights, night vision, and radar observer trainers are good, bridge operations trainers are good and contribute to effective competence-building in seafarers.

In the light of the principles of maritime education and training as enacted over one hundred years ago, and the truths and myths of sea training, the changes that would result from the proposed IMCO standards are not constructive and would adversely affect the Maritime College.

We are pleased to testify to this committee which has shown such a constructive concern that the impact would be negative. There are others with unbounded enthusiasm for an improved image who may be less constructive. The U.S. Coast Guard, for example, published in the Federal Register, Vol. 43, No. 147, July 31, 1978, notice to the public of its intent to formulate proposals for regulatory implementation of the IMCO results. The notice quotes the 80 percent human error statistic and that "the improved training and qualification standards, when implemented, should better qualify personnel on board ships to avoid maritime casualties." Although not mentioning entry-level officers specifically, the intent seems clear "* * * to publish proposed rules * * * which would call for higher standards than are presently required by U.S. rules and regulations for licensing * * *" In reply to a joint letter from all the State Academies to make haste only with due deliberation, the Commandant made clear that the one-year requirement, Regulation II/4, "will impact your existing licensing programs" since that Regulation "is one of the requirements which the Coast Guard intends to implement." So it seems the Regulation is like Mount Everest; it is there, so we must climb it.

The Coast Guard said that they may "* * * be receptive to reviewing shiphandling simulator training programs as a possible equivalent to partial sea service." We have no expectation that the Coast Guard will move toward providing any such facility. There is also no probability that the States can finance such multimillion dollar installations.

The State schools can clearly see the storm warnings. If the one-year sea time rule is enacted, then the sea time requirement doubles, and our training ship operating costs would become unmanageable, not to mention the scheduling problem. If shiphandling simulator training is the perceived substitute, we can't finance that either. The irony is that the severe burden is an unfounded external Regulation.

Given funds, we would improve our effectiveness not by extending sea time, but by a proper training ship and improved training devices afloat and ashore. They did not ask us at IMCO, Mr. Chairman, and we are grateful that you have.

We are convinced that Admiral Luce and the Congress of 1874 were correct, and a proper training ship is the way to go. There are two important points: that it be a Training Ship and that it be kept in a state of good repair.

I testified at length about the state of repair in my testimony of 25 February 1980 on the Fiscal Year 1981 Maritime Appropriations Authorization Act. Very briefly, I offered the opinion that the ship is a large, valuable, effective investment and that it should be kept in good repair both for Cadet training and for use in a national emergency. General Order 87, Part 310.4 actually requires that the vessel shall be maintained in good repair and expenses will be borne by the Administration. Since that has not been done, there is a backlog of work to be done. Recent events give us some hope of favorable action.

The first point is to make it a Training Ship, clearly the intent of General Order 87. The USNS *Barrett* became the Training Ship *Empire State* simply by change of name. Not one dime has been authorized or spent by the Federal Government to make the words come true. The State of New York has funded some material and work to make it so, but this expenditure of State funds on Federal property is not a priority State budget item.

Judging by the enthusiasm of IMCO and the U.S. Coast Guard for Automatic Radar Plotting Aids as a Collision Avoidance System, such a training device on the ship would improve training effectiveness. Here is an external trend we fully support, and would like to see funded. That is one example of out-fitting a training ship.

One final derivative from the original principles: When Admiral Luce delivered the first schoolship, if he did, he did not stay with the ship. But Captain Pythian and other Federal officers did. Now I turn to Section 310.5 of General Order 87, the section titled "Personnel." Parts (a) and (b) are relevant. Part (a) relates to the "Section and appointment by State authorities," and Part (b) specifics, "Personnel for training vessels furnished by the Department of Commerce."

What better way to emphasize the Federal-State partnership than to read Part (b) as an extension of legislation in the Maritime Academy Act of 1958 and in the proposed Section 1304 of H.R. 5451 to specifically name training ship personnel to be furnished by the Department of Commerce?

In summary, Mr. Chairman, sea training in a proper training ship that is conducted as an extension of an ashore training program is most time-effective. The ashore training must include alongside the dock use of the ship-as-laboratory, and naturally includes guided classroom and self-study, and exercise on training devices, such as blinkers and bridge operations simulators. Supplementary exposure to actual commercial operations, visits or short tours on board operating units, provide familiarization with functions of personal relationships, things needed to be learned later such as company loyalties, the pressures of cargo or liner schedules, the routine of everyday life, and perhaps the special demands of tankships or hazardous cargo.

This format is time-tested as one way to go for the best entry-level officers, Mr. Chairman, and I am pleased to testify to that.

Mr. PANSHIN. We appreciate your statement.

The point I would like to pursue initially for the sake of the hearing record is to set forth what the present training cruise practice is for academies, and how much time is accumulated. The present Coast Guard requirement is for a total of 6 months.

My understanding from California's testimony, Admiral Rizza, please correct me if I am not right, is that your students in the course of their time at your academy take part in three cruises for a total of at least 36 weeks.

Admiral RIZZA. Yes; that is correct.

Mr. PANSHIN. Thereby exceeding the 6-month minimum requirement.

Admiral RIZZA. That is correct.

Mr. PANSHIN. And my reading of Maine's testimony is that your students, Admiral Rodgers, take part in three cruises, two on your training ship, one on a commercial vessel, for a total of at least 6 months; is that correct?

Admiral RODGERS. That is correct.

Mr. PANSHIN. What is the situation for Massachusetts, Commodore Hendy?

Commodore HENDY. It would be the same as Maine.

Mr. PANSHIN. In terms of total time do you also——

Commodore HENDY. Sixty days a year.

Mr. PANSHIN. When you say same as Maine, you also use the commercial vessel in the way that his academy does?

Commodore HENDY. Yes; a portion of our one class, our junior class, gains time on commercial vessels, a small percentage.

Mr. PANSHIN. Where at Maine every student in that middle class goes on the commercial cruise; is that correct?

Admiral RODGERS. That is correct.

Mr. PANSHIN. But in both cases the cadets gain satisfaction of at least the 6 months. In either case does it substantially exceed that, or is it usually just about that amount?

Admiral RODGERS. In the case of Maine some of our students who are on commercial vessels spend more than 2 months. They may go on an extended voyage of 3 months, but as far as the training ship is concerned, we have been limiting our sea experience there to around 60 to 62 days. We used to go an extra week but when finances and the oil crunch came along we really cut it to the bone. With Federal support for oil we will be able to extend a few days and not cut those corners as closely.

Mr. PANSHIN. Commodore Hendy?

Commodore HENDY. Massachusetts follows a similar plan, and would also extend its time a week if we see additional funds from the Federal Government in assistance.

Mr. PANSHIN. We are achieving some success in assisting with fuel oil, and hope that will continue.

Admiral Kinney, what is the situation in New York?

Admiral KINNEY. The New York practice is 6 months' seatime, all in the training ship, three cruises for each cadet.

Mr. PANSHIN. Have each of you seen, moving on to a different question, the final equivalency package that Marad has submitted to the Coast Guard, and do you agree with it?

Commodore Hendy?

Commodore HENDY. I think I will defer to my colleages.

Admiral RODGERS. Well, as Admiral Kinney had suggested before, we think it unfortunate that we got ourselves in this predicament in the first place, but assuming we have to do something about it, I would say, yes, the Marad recommendations reflect pretty much the suggestions we have made. The only thing I can say between the Marad recommendations and the Coast Guard acceptance is probably the question of whether or not on a day-to-day basis, a training ship is worth a little more than an observer on a commercial ship. We think it is and would like to get a little extra effort for that.

Mr. PANSHIN. Admiral Kinney.

Admiral KINNEY. I find it very hard to determine equivalents. The U.S. delegation departed for London with a prepared position for the State schools of 6 months seatime. They returned with 12 months. Now the effort seems to be to dredge up something that we can call seatime when it is not. I cannot get excited about that exercise.

Admiral RIZZA. We agree with Marad. However, I still think 6 months at sea as we train is equivalent to 1 year at sea as now

approved by the Coast Guard, but we do go along with the recommendations Marad made, which were our own recommendations.

Mr. PANSHIN. Your comments are very clear in that regard. Again a question for all the academies. You now have the equipment and I am thinking particularly of simulators and small craft, to meet the proposed Coast Guard requirements that might be accepted under the equivalency package. If you do not, what will be required in each of your cases? How much will it cost and who should pay for it?

Commodore HENDY. Well, I am going to make use of my academic VP who has been waiting for an opportunity to speak on the simulator problem.

Captain MOTTE. At the moment, we are in the process of going out to bid on the radar simulator. This is probably 10 years overdue but we expect to have that in place within the next 9 months. Our immediate requirements would be for a full function ship simulator——

Mr. PANSHIN. Excuse me for a moment. I notice that phrase in the testimony as well. For the hearing record, would you inform us what a full function simulator is?

Captain MOTTE. It has been referred to as a ship holding simulator in other testimony but in general terms it is referred to as a full-function simulator in that it performs other functions. As far as the academy is concerned, where we are more involved with basic training rather than upgrading training for serving mariners, the basic function is for the initial license situation; this would require us to look at a furtherage of parameters than just ship handling. By that, I mean both the loading situation and stability, ship stability, and the various damage control and safety features. I think I have heard the sum of $5 million attached to the simulator. There are those available at a lesser price. I think Mr. Friedberg mentioned in the United Kingdom, I have for reasons that may be obvious, some sort of knowledge in that area, there will be five full-function ship simulators fully operational by the end of this year in 5 of the 12 merchant marine academies in that country.

Two months ago I was a student on one of those ship simulators and I think initially, I felt somewhat as a merchant mariner, a seaman, a little dubious about that situation for replacing seatime but it did not take me many hours operating that simulator to realize the valuable time that would give to an academy such as we have here.

I think possibly if you look at all the simulators, optimally, we would liken the housing for these simulators in the range of $7 to $8 million dollars at each of the academies. That is looking at it from the optimum standpoint. It is not just the simulator, but the building to house the simulator.

Mr. PANSHIN. Have you any plans for acquiring smaller vessels which the Coast Guard has indicated they would accept?

Captain MOTTE. We do have a vessel, a sort of a converted gunboat that we took a gas-turbine engine out of and replaced it with a diesel engine to make it somewhat duplicative of commercial operations on a scaled-down version. I think it is quite realistic and we do have plans, eventually, when funds become available, to bring that into the training side of things.

Mr. PANSHIN. Very good; Admiral Rodgers.

Admiral RODGERS. We have a radar simulator and also a collision avoidance radar in place but we do not have the bridge simulator which is the most expensive of those we are talking about and certainly Maine is not going to be in a position to buy it so we would have to look to the Federal government, I assume, to purchase that.

With regard to a small vessel, we acquired a Navy tugboat a few years ago and attempted to use that. Unfortunately we could never get a Coast Guard inspection certificate as a training vessel. As we poured money into it to try to correct problems, it became evident that the only proper way to go would be to design something new as a training vessel.

I might mention we have gone beyond that and have been consulting with authorities at MIT with regard to the design providing characteristics that would permit that to operate as a simulator of larger vessels. I have a very encouraging response to that question. These things can be done, depending on your degree of sophistication. That is the direction in which we want to go. I am in the process of trying to raise some money for it. I would hope we would get some Federal assistance through Marad for that portion of the vessel which has to do with the simulator aspect.

Mr. PANSHIN. Do you still have the tug?

Admiral RODGERS. No, it was costing money and we were not permitted to use it and it would have cost $100,000 to make use of it.

Mr. PANSHIN. You are talking about new construction?

Admiral RODGERS. Yes, sir.

Mr. PANSHIN. Let me ask you one additional question. You referred in your formal testimony to the possibility of Marad's proceeding with two new schoolships as a replacement for the five existing ones. What sort of role would you foresee in that case for the kind of smaller vessel you are talking about building; that is, one that would have the versatility of simulating different ship characteristics? What part would you hope that would play in the program that Maine Maritime conducts?

Admiral RODGERS. Well, I am still an advocate of the smaller type vessel, regardless of what we do. I still think that can be an extremely valuable part of our training program and I do not think it would change if we built new ones.

Mr. PANSHIN. Let us proceed. Admiral Kinney.

Admiral KINNEY. We have a rather rudimentary radar simulator that meets the current requirements. We do not have the funds nor do we expect to get them to obtain a more sophisticated simulator, let alone a bridge simulator. We have no small craft which would fit the description Admiral Bell gave this morning. It did not sound very small. I do not think we could obtain the funds to purchase the type of craft he has in mind nor to operate it.

Mr. PANSHIN. Thank you.

Admiral RIZZA. In California we do have the radar simulator, a tanker simulator—very sophisticated, does everything as far as loading, unloading, stress, trim, and we are inputting a capability into it now for the inert gas system and tanker crude oil washing system. We have collision avoidance on the training ship, even

though the ship is old, we do have the modern equipment which will provide good training. We are hopeful of getting a diesel engine simulator. We do have small vessels, we have a complete program in small vessel training. And as Admiral Benkert said, we consider that important.

How do you pay for these simulators? We pay for them by conducting programs for the industry, hoping that will pay for maintenance and upkeep. We do need a bridge simulator as one calls it. We are talking about the expense of a simulator; they will be expensive initially, but in the long run, I think they will be far cheaper than shipboard training will be in about the next 15 to 20 years. We have the capability to build everything now, the capability is here if we want it. You are thinking of the expensiveness. Yes, they are expensive, initially but think of the expenses caused by accidents and collisions, 70 to 80 percent of accidents and collisions are caused by human error. It is my belief simulators will bring that down significantly. I really think we should push hard for simulators, regardless of costs. Think of the accidents it will prevent and the money it will save. I do not think there is any excuse for the accidents at sea, and I think the academies should all have this ship handling simulator, and as Captain Motte indicated, it should be all-inclusive. Everything should be put into one ship handling simulator because the capability is there.

Mr. PANSHIN. You indicated with respect to your tanker simulator, that it was open to industry?

Admiral RIZZA. Yes. We have two offers. One for veteran officers, chief mates, and another for junior officers, second and third mates. The tanker companies on the west coast are sending their people who can practice and get experience that they cannot with a ship.

Mr. PANSHIN. Did that kind of continuing education program develop at your initiative, industry's initiative or a combination of the two? Can you tell us how that came about?

Admiral RIZZA. It developed at our initiative, we asked industry to help us, they give professional and technical assistance in developing what we needed to develop in a computer which was added to a console given to us by one of the shipping companies. At a cost of about $150,000 and about 8 months of work we developed a highly sophisticated tanker simulator.

Mr. PANSHIN. Have you any others that are used for continuing education?

Admiral RIZZA. We have our radar simulator. If we get our diesel engine simulator we have inquiries from industry for their people to take this training. We are looking at the continuing education program because there is no way we can pay for the maintenance and upkeep of it from our budget. So we do this to maintain our equipment.

Mr. PANSHIN. Regarding your radar simulator, to what extent does that duplicate the simulator Marad offers?

Admiral RIZZA. As far as I know, it does not interfere with it because there are enough customers to take care of both of us. We see no conflict.

Mr. PANSHIN. If and when you acquire a full-function ship-handling simulator, would you expect to use it in the same way?

Admiral RIZZA. Yes, we very definitely expect to use it in the same way, because that is the way we will have to raise funds to maintain it. The west coast industry has already said they would use it and they welcome it.

Mr. PANSHIN. What is the situation with the other academies? Do any of you have simulators you presently use for continuing education purposes, and if you acquired any of the simulators we have discussed today, would you expect to make them available in this way in the future?

Admiral KINNEY. New York does not currently have these nor do we plan it. We restrict our work to the masters degree in transportation management. We have about 125 students attending the 2-year program leading to an equivalent of a masters in business administration of transportation, focusing not only on maritime activities but also the airlines, railroads, and trucking.

Mr. PANSHIN. Are those fulltime?

Admiral KINNEY. About 20 are fulltime, the remainder are people working in the industry in downtown New York going to school at night and weekends.

Mr. PANSHIN. Would simulator training be any part of their master's program?

Admiral KINNEY. No. These are not of necessity mariners but primarily people from the business end of the industry and in the types of work they do, have no simulation equivalent.

Mr. PANSHIN. Are some of your students seafarers who intend to go back to sea upon completion of the degree?

Admiral KINNEY. Usually not. Those persons are usually from the companies and serve in shoreside capacities and are not seagoing.

Admiral RODGERS. We presently use our radar simulator and collision avoidance simulator for personnel coming from the fleet. The Portland Office of Marine Inspection refers officers seeking a renewal of their license and we offer a refresher course one Saturday a month.

We have just acquired a diesel simulator and we expect in the very near future to have a course available on that. We have a tanker simulator which was built by students, homemade under the supervision of an instructor, but it is strictly for the undergraduate program right now.

As a concept, Maine Maritime Academy is developing a new division of advanced maritime studies to create programs, to meet some of the IMCO requirements for fleet personnel. That has already officially been put into effect. We have put a lot of money into a building to provide adequate facilities. So in time we will be doing this on a grander scale.

Mr. PANSHIN. In terms of your education program, I have not personally been to Castine, Maine but I gather you are not in a center of population. Does your location inhibit in any way the ability of seafarers to come to your school for their continuing education program?

Admiral RODGERS. In the mind before they get there. When they get there and recognize the quality of life that is available to them, they come back again. Yes, I usually run into some reactions of that nature. But we are successful in the things we are doing. We

have been running other programs, we run a very effective ship medicine course, fully subscribed to every time we run it. One of the little sidelight things I can say, we have facilities, so if an individual wants to bring a wife or family and combine it with a vacation—we can accommodate them. It is more effective in the summertime, but on the other hand there are a lot of indoor and outdoor winter activities available.

We have been trying to put together seminars on the human element problems aboard ships. Why are there accidents in spite of training? In other words, we are very active in trying to get together a complete array of programs for the maritime industry.

Mr. PANSHIN. Even though all roads might not lead to Castine, some do.

Admiral RODGERS. There is only one road to Castine. We are at the end of a peninsula. Once you get there, you forget the rest of the world. It makes up for it.

Commodore HENDY. Captain Motte has been actively engaged in this program so I will ask him to respond to this.

Captain MOTTE. Because we have realized for so long that the bridge simulator is an absolute necessity we had a survey of shipping companies on the east coast, we had responses from 30 of them which indicated they would reserve berths for ship officers. We used that as input into a computer program to look at the feasibility of a low-interest loan to fund minimal set ups for a full-function ship simulator. The lowest price ship simulator at that time was a simulator which only looked at the nocturnal scene. Therefore, you were handling a ship at night and in a reduced-visibility situation. I think that probably accounts for 80 percent of the difficult training situations that one would get into. We proved by judicious juggling of the computer program that it was possible to fund such a program over 25 to 30 years. When you inject realism into that and look at the possible redundancy of such a program, I was not prepared to go any further with it. But it was an indication to me, that a rather more sophisticated full-function ship simulator could at least be funded from an operational viewpoint by going to industry and having normal instructional downtime being taken up by industry requirements.

Mr. PANSHIN. Thank you. All of you have been clear in your need or strong preference that each academy receive a ship-handling simulator. I am sure as this committee proceeds and the Administration proceeds with its plans where some kind of shared use is possible this is going to be an active item for future discussion. I have just a couple more questions for the State academies.

Admiral Rodgers, you have indicated your students go out to sea on a commercial vessel for one of their three cruises. How does this training they acquire on the commercial vessel compare with that provided by your school ship?

Admiral RODGERS. It varies from ship to ship but the sum total we think supplements the training ship very nicely. Students look forward to the opportunity to get out into the real world, not only the technical side of it, the problems of dealing with people—I am sorry, I did not bring a copy with me—but we prepare a so-called training manual for the student before he goes out so he has a sea project. That is corrected when he comes back. The Coast Guard

requires that. It is a very effective training period for the student out there, completing that manual and so forth.

Second, he has to submit a personal diary. We certainly prime them for certain things we want them to look into. We told all the students to check on what kind of seagoing hobbies do you find while at sea. That is an example of some of the things we try to do. I read every one of the reports that come back. Occasionally, you hear a student say, because of problems, they will not let me work, or I could do only work, or the chief mate hated cadets, or something, but that is a really isolated case. For the most part, the people aboard the ships are very helpful. The students come back with good reports on their relationships and the help they receive. I think it supplements. I still think the training ship is the most valuable but this is a good supplement to it.

Mr. PANSHIN. If it were a matter of one or the other, then are you saying the training ship is superior?

Admiral RODGERS. If I had to choose one or the other, I would opt for the training ship, yes.

Mr. PANSHIN. Commodore Hendy, what has been the experience at your academy?

Commodore HENDY. The few that we are able to put on merchant ships also have a sea project assigned to them, which they have to report back on, but we still depend largely on the training ship as our basic means of training, and of the two systems, we would prefer the training ship.

Mr. PANSHIN. Approximately how many are you able to place per year on commercial vessels?

Commodore HENDY. We had approximately 70 during this past year.

Mr. PANSHIN. How do you make that selection when only some of a class may go?

Commodore HENDY. Based on the academic standing of the cadets in their class.

Mr. PANSHIN. Is there great competition for that?

Commodore HENDY. There is great competition but it is still based on the academic standing. We start with the top of the list, the highest one in the class and go right down. Those who wish to avail themselves of that opportunity are allowed to do so, and we continue down the list until we run out of ships to assign them to.

Mr. PANSHIN. If offered, does a student usually accept?

Commodore HENDY. Usually they accept.

Mr. PANSHIN. Thank you. I think each of the academies, except New York, has responded to the role they perceive for smaller vessels in their training program.

Admiral Kinney, what would the situation be with New York Maritime?

Admiral KINNEY. With respect to the use of smaller vessels as substitute for seatime?

Mr. PANSHIN. To satisfy a portion of the seatime requirement under the proposed IMCO convention.

Admiral KINNEY. My comment has been that we foresee no possibility of obtaining such a vessel, manning it, and operating it under our present fiscal constraints in the State university.

If you want my comment on its value, I would say that it has value, that one can learn a great deal about ship handling and bridge experience from an adequate, what the Navy would call YP or yard craft, such as the Naval Academy and the Officer Candidate School and the Surface Warfare School utilize for similar training. There is value.

Mr. PANSHIN. If then you were able to obtain such a vessel, you could incorporate it into your program?

Admiral KINNEY. That is affirmative, if you can find the time for it. I share Admiral Rodgers' concern that each of these additions has to replace something, and I am not sure that in preparing initial license officers, that is a proper priority.

There has been a great deal of talk about ship handling, but I would repeat, in general, third mates are not ship handlers. They are much more line handlers and watch officers than ship handlers. They will handle a ship only in an emergency; man overboard, maneuvering in tight circumstances to avoid collision, but masters and pilots handle ships.

Mr. PANSHIN. Thank you.

I believe minority counsel has a question or two.

Mr. LOSCH. I would like to clarify something for the record.

Admiral Kinney, you mentioned in your testimony this new 1-year requirement would provide problems and hurt your ability to graduate officers.

Admiral Rizza, you mentioned a similar problem, and said that it would seriously disrupt your 4-year, 11-months-per-year curriculum.

Admiral Kinney or Admiral Rizza, is it not true that the 1-year requirement is presenting a dilemma in that if you want to maintain a 4-year academically accredited college, the 1-year seatime requirement for a license is in conflict, and you are forced into making a tradeoff between meeting the Coast Guard requirement and the Accreditation Committee requirement?

Is it not true that this attempt to be both a 4-year college and a school graduating merchant marine officers coming into conflict with the new Coast Guard requirement?

Admiral KINNEY. Your analysis is correct, that it does create a conflict with the requirements of a baccalaureate degree. We could go to a longer period of training. We are already compressing almost 5 engineering years as well as deck years into 4, so additional requirements mean either degrading the current programs, which I believe create valuable people for the industry, or lengthening the program, and when we speak of the Coast Guard requirements, I am rather curious as to how they rectify in their own mind the fact that their academy graduates will not meet the standards which they are espousing.

Mr. LOSCH. I certainly recognize that inconsistency, having been a Coast Guard Academy graduate and also having qualified for a merchant mariner's license. There are issues beyond the one you raise with respect to the Coast Guard minding its own house and at the same time trying to regulate other schools. I recognize that.

Admiral Rizza?

Admiral RIZZA. Yes, it would cause a conflict in our case also. Either we would have to take something out or extend the program

or instead of three cruises go on four cruises, that is, we would have to go on four cruises of 3 months each. But we must limit the number of people. We won't take over 300 on our ship, because we feel that that would seriously impair the very high standards and the intensity of the training program that we put these kids through.

Mr. LOSCH. I am certainly not suggesting that you trade off your academic accreditation in order to fill your mission of graduating merchant marine officers, but certainly that point will be raised by private training institutions. I just wanted to get those points made for the record. Perhaps one of the ways to deal with that problem will be to lengthen the 4- to 5-year curriculum.

Thank you.

Mr. PANSHIN. Thank you.

We have completed the questions for this panel.

I would like to call the next panel. The next panel is John Mason of the Seafarers' Harry Lundeberg School of Seamanship, and Capt. William Rich of Masters, Mates & Pilots.

While they are proceeding to the table, let me inform you that there is an unusual amount of activity on the floor today, and it has become more complex than expected. The chairman did telephone and asked that we continue, and we shall.

STATEMENTS OF JOHN A. MASON, DIRECTOR OF VOCATIONAL EDUCATION, THE SEAFARERS' HARRY LUNDEBERG SCHOOL OF SEAMANSHIP; AND CAPT. WILLIAM L. RICH, JR., DIRECTOR OF RESEARCH AND TRAINING; MARITIME ADVANCEMENT, TRAINING, EDUCATION, AND SAFETY PROGRAM; MASTER, MATES & PILOTS

Mr. PANSHIN. Mr. Mason, may we have your testimony at this time?

STATEMENT OF MR. MASON

Mr. MASON. Certainly. We appreciate this opportunity to testify. As you know, the Seafarers' Harry Lundeberg School of Seamanship is the largest educational facility for unlicensed seafarer training in the United States.

The purpose of the school is to train, guide, and encourage young men and women in careers in deep sea and inland industry as well as to upgrade older seafarers to higher ratings and license.

We graduate approximately 1,000 entry trainees each year to begin these careers in the maritime industry. The upgrading of the seafarers begins only after they have acquired the necessary sea time on commercial ships and tugs.

The school's inland program has grown since 1973 into a complete licensing curriculum, training tugboat pilots, mates, operators, and engineers.

In this period of time we have trained approximately 539 of these different ratings. I have included that for the record. The most important concept by showing all those different ones is that each man must meet actual seatime requirements before he obtains his license and before he has the opportunity to come back to the school to upgrade.

As an example, before obtaining the uninspected engineer's license, the applicant must have 3 years of actual engineroom service.

Practical experience on deck and in the engineroom should always remain the mainstay behind any licensing curriculum, decisionmaking on the bridge and in the engineroom can only be learned in on-the-job training environments.

In our operator licensing course, we graduated approximately 350 in past years, each student spends 90 hours operating our tugs and barges, but we have found that a student who already has background experience in the wheelhouse is the only one we can polish into a skilled operator.

Boat handling requires practice, and that practice comes with long hours of on-the-job training before he or she arrives at the school.

The LNG course that we developed at the school is a good example of building a training program around skilled seafarers. We took seafarers with years of seatime experience and taught them the safety and operational procedures to handle the sophisticated systems and controls on the LNG ships.

The success of this program was due to our students' practical background gained from seatime on many other types of ships.

Those seafarers that we had coming into that program were already AB's, they were already oilers, they were already wipers, they were already bosuns, and quartermasters. That seatime that they gained actual experience was invaluable when we got them into the classroom and retrained them on one particular type of vessel.

Since our first LNG course in 1974, 700 seafarers have graduated from the LNG training program. The LNG course has been reviewed and evaluated by the Coast Guard, Maryland State Board of Education, Charles County Community College, American Council on Education, and the LNG shipowners. The shipowners' participation is the most important because they represent a constant input of state-of-the-art performance and objectives, and without their cooperation this course would have not been half as successful.

If you don't have the people that actually need the manpower contributing their ideas and views, then the courses are lacking quite a bit.

The maritime industry actively participates in the Seafarers' Harry Lundeberg School of Seamanship's educational processes. An active advisory board and frequent technical panel meetings enable us to propose and critique curriculum to meet changing maritime needs.

The use of commercial ships and tugs to satisfy sea training requirements will also be facilitated by a close interaction between industry and the maritime schools.

By bringing the advisory boards and the technical panels down to the school, we found that this close-working relationship with us has brought about them saying, "Send us some people to ride the ships. Send us some people to ride the tugs."

At the Seafarers' Harry Lundeberg School of Seamanship we have 2 training tugs that are in constant use, servicing 14 different courses of instruction.

The concept of a larger training vessel with a large crew for extended voyages has been discussed many times at our school. We feel it is unrealistic economically, because of the upkeep, fuel, and constant equipment changes. It is also unrealistic because educationally it will train only one type of ship.

In other words, if you are stuck with a steam-powered engineroom, and now with the diesels becoming more and more frequent onboard the ships, and, of course, as the complete mainstay for the tugs, you have a real problem.

Simulators are important educational tools, but only in conjunction with seatime experience and good instructional guidance. I have found too often very expensive training aides not in use. The reasons: lack of instructor interest, outmoded equipment, lack of student interest, and inadequate equipment, or not a believable simulation.

This comes from spending quite a bit of time in the classroom. Everybody down at the school, the entire staff, we all teach, and this is just about an everyday process. We have simulators that we use quite often.

A cost-effective simulator to complement many varied training programs is hard to find. At the school we have many types of simulators ranging in cost from a few hundred to a $150,000 engineroom simulator. Even the best simulator cannot replace practical at sea experience.

Maritime education and training must always be reevaluated. That is, once again, going back to the importance of having the advisory boards, and having direct input from the industry.

I appreciate the committee's interest in our educational philosophy, and I will be happy to answer any questions that you may have.

Mr. PANSHIN. Thank you for your testimony. I will hold the questions until after we have received the testimony from our second witness, Capt. William Rich.

Captain, would you present at this time your summary of Captain Lowen's testimony.

STATEMENT OF CAPTAIN RICH

Captain RICH. Thank you very much, Mr. Chairman.

Mr. Chairman and members of the subcommittee, my name is Capt. William L. Rich, Jr. I am the director of research and training for the International Organization of Masters, Mates & Pilots, AFL-CIO.

As the chairman is aware, I am appearing here today at the request of Capt. Robert Lowen, the president of the M. M. & P., to deliver on his behalf, on behalf of the M. M. & P. a statement to the subcommittee.

Captain Lowen, Mr. Chairman, apologizes for his inability to get here today. He had intended to be here but has been delayed in New York.

The prepared statement that has been submitted by him is submitted to the committee for the record, and I am prepared this afternoon to give the subcommittee a summary of that statement, and to reply to any questions.

Mr. PANSHIN. Please proceed with your summary. Captain Lowen's statement in its entirety will be included in the official record of the subcommittee.

[The prepared statement of Capt. Robert J. Lowen follows:]

PREPARED STATEMENT OF CAPT. ROBERT J. LOWEN, PRESIDENT, INTERNATIONAL ORGANIZATION OF MASTERS, MATES AND PILOTS, ILA, AFL-CIO

Mr. Chairman and Members of the Subcommittee; on behalf of the Masters, Mates and Pilots I am grateful to you for this opportunity to express our views on maritime training with special emphasis on the IMCO International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 and the activities of Federal and State maritime academies in connection with the Convention.

As I am sure this Committee is aware, in 1967 the MM&P established with the cooperation and support of its contracting employer companies an extensive training program. That program, called the Maritime Advancement, Training, Education and Safety Program (M.A.T.E.S.), was initially established to meet the emergency needs for trained maritime personnel created by the Vietnam war and the consequent need for massive sealift capacity. The M.A.T.E.S. Program and its Maritime Institute for Technology and Graduate Studies in Linthicum Heights, Md. (MITAGS), has continued to train our members since that time and is dedicated principally to the improvement of professional skills of the masters and officers employed on our contracted vessels. I think it is important to emphasize that, since the passing of that original need for initial licensing created by the Vietnam emergency, we in the MM&P and our employer companies have confined our educational and training activities at MITAGS to secondary or what might be called post-graduate training. We have done so with the tacit understanding that the Federal and State maritime academies would fill the need for training officers at the entry level. We have concentrated on the more advanced kind of training, including such things as license advancement, collision avoidance, all-weather navigation, cargo loading and unloading, bridge controls, medical training, maritime law and ship's business and other advanced courses designed to upgrade the skills of our members.

Recently, however, there has been a disturbing development in maritime training that is causing our organization to re-examine its historic position of leaving to the Federal and State academies the task of initial licensing. Several of the State academies, including Maine, Massachusetts and California, for example, have been engaging in the more advanced post-graduate kind of training. In addition, the CAORF facility at Kings Point is moving toward abandonment of the original design of its computerized simulator as a research tool and is beginning to engage in training activities in direct violation of a long-standing cooperative accord existing among our organization and the government-supported maritime training institutions. We urge this Committee to withhold any Federal funds for any purpose related to secondary or post-graduate education and training and leave that field were it belongs—to the industry and industry-supported institutions.

Turning more directly to the IMCO Convention, I will not repeat some of the testimony already given to this committee. I believe, for example, that Rear Adm. Henry H. Bell from the U.S. Coast Guard has explained to this committee the background, basic structure and general effect on U.S. requirements of the IMCO convention. There are a few points, however, that I would like to emphasize.

In the first place, I think it important for this committee to realize that in all of the very extensive provisions of the IMCO Training convention, the only significant requirement that is not already in our own domestic law is the additional requirement for sea service that will be required before cadets of the academies can be licensed. It should be pointed out here that every provisions—and there are hundreds of them in the convention—was hammered out by representatives not only of the major seafaring nations, but by representatives of developing countries as well, over a period of many years in dozens of meetings at IMCO and at regional international groups. Our organization participated in developing and drafting this convention from the very beginning.

It has been our purpose throughout those efforts to try to raise international standards of training, certification and watchkeeping to a level comparable to those being followed in our own merchant marine. In large measure we succeeded in those efforts. Once it enters into force, the new IMCO convention on Standards of Training, Certification and Watchkeeping will work a world revolution in the field of maritime safety. For the first time in its entire history, IMCO will have succeeded in producing an international convention that emphasizes the most important

factor in safety—the human factor. The convention will require all maritime nations who ratify it, including the developing nations, to follow standards of training and certification that will go farther than ever before, toward protecting lives, property and the marine environment. We are proud of our efforts, we are proud of the efforts of the U.S. government and of the U.S. Coast Guard in accomplishing what has been done and we sincerely hope that the U.S. Senate will ratify this convention soon.

In all these efforts it is remarkable that other nations agreed to many provisions that will require revision of their own national laws. The only revision we will require is additional sea service for cadets and, in our judgment, the upgrading of that requirement is long overdue.

We are happy to learn that the U.S. Coast Guard is making efforts to make this new requirement more easily realizable by the academies and we are also happy that they are going to make efforts to see to it that smaller vessels will also be able to meet these requirements through training and particularly through simulator training as a substitute for sea service.

There is much more that I could say on this subject, Mr. Chairman, because our organization is convinced that quality of service in this industry is a key to our ability to compete. We believe that superlative American performance, the high quality of our personnel and the safety of our equipment are all hallmarks of the American merchant marine. No subject that this subcommittee or its parent committee could consider is dearer to our hearts. But I know, Mr. Chairman, that there are many other witnesses and many other facts of this subject that you wish to consider, and I will not presume upon your generosity in permitting me to testify any further. I thank you once more for this opportunity.

Captain RICH. I don't believe it is necessary for me at this time to go into the history of the development of the maritime advancement training education and safety program, and the development of the Maritime Institute of Technology.

There are two important issues that have come to our mind today. I perceive in listening to previous testimony that the academies at this time feel that their programs are threatened by the seatime requirements of the IMCO Training Convention. The second issue is the change of the status in the relationship between the academies and organizations such as ours.

The academy system is a major source of licensed officers who come into the M.M. & P. On becoming members of the M.M. & P. they qualify for attendance at the Maritime Institute of Technology and Graduate Studies for the purpose of raising their license to the next level and improving their professional skills through the courses offered at the institute. This is an established practice wherein industry, labor, and management properly fulfill their role and responsibility. We feel strongly that this is not the role of the academy organizations.

It is true that during the 7 years that I have been a member of the IMCO subcommittee on Standards of Training that the seatime requirement was not an item of any significant debate.

Admiral Benkert, the president of AIMS, who, at the time of the convention conference representing the United States, as chairman, and while in his position as Chief of Merchant Marine Safety has explained in his testimony today the origin of the change in the sea time requirement as we see it in the convention today and his explanation is correct.

I believe that Admiral Henry Bell's comments and those of the representative of Marad and their equivalent package suggestion is an acceptable solution to the academy group's problem.

We believe that the Coast Guard and Marad's recommendation will bring the academy training system into a balance and hope-

fully will move the responsible Government agencies to give the academy group the necessary tools to do this.

The simulation programs now in place at the Maritime Institute of Technology and Graduate Studies will be expanded by the addition of a full-motion ship simulator and an LNG simulator. This is not an overemphasis in our experience of the application of simulation in maritime training. This addition, which will be on line and functioning in the spring of 1981, brings our program into complete balance. What is being done now and what is being added to the Maritime Technology and Graduate Studies is the result of the establishment of the MITAGS trustees which role should continue to be the responsibility of us in industry.

I don't believe that Government bureauracy will be permitted to impede the academy group from adjusting their programs to national or international requirements in a rapidly changing industry. Captain Lowen stated that the quality of service in this industry, through its trained people, is the key to our Nation's ability to compete.

We believe that the superlative American performance, the high quality of our people from State, Federal, and labor, management, postgraduate educational systems collectively are the hallmarks of our merchant marine today.

We would not like to see anything come down that is going to impede the development of our greatest natural resource which is our people. Properly managed, these resources will be the factors which will bring our merchant marine back where it belongs.

We are concerned about the academy group's expansion into postgraduate education and training activities. I think it is important for all to realize that since the beginning of our own original program under the collective bargaining agreement of 13 years ago, we in the M.M. & P. and our employer companies have confined our educational and training activities at the Maritime Institute to secondary, or what we call postgraduate, training. And we have done this, Mr. Chairman, with the tacit understanding that the Federal and State maritime academies would fill the need for training officers at that entry level.

We concentrate on the more advanced kind of training, including such things as license advancement, collision avoidance, all-weather navigation, cargo loading and unloading, bridge controls, medical training, maritime law, and ship's, business, and other advanced courses designed to upgrade the skills.

Another comment, Mr. Chairman, the CAORF facility at Kings Point is moving towards abandonment of its original design of its computerized simulator as a research tool, and is beginning to engage in training activities in direct violation of a long-standing cooperative accord existing among our organizations and Government-supported institutions.

The M.M. & P., Mr. Chairman, will assist in any way we can to have the Federal and the State academies get any kind of funds they need for original entry license education and training, but we would urge this committee and its parent to withhold any Federal funds for any purpose related to the functions that we perform. It belongs to the industry and the industry-supported institutions.

We sincerely hope that the committee will be able to give the State and Federal academies all the assistance they need, so that they can continue to be a vital input into the system.

We can be of assistance to the academy group by making available to them on a time-sharing basis the simulation programs at the Maritime Institute of Technology and Graduate Studies.

We are available for discussion of time-sharing programs.

Thank you very much, Mr. Chairman.

Mr. PANSHIN. Thank you, Captain Rich.

You indicated that your sophisticated bridge simulator at the Maritime Institute is expected to be completed next spring; is that correct?

Captain RICH. Yes, Mr. Chairman.

Mr. PANSHIN. Your testimony is clear on the role you envision for simulator training on the one hand, for initial licensing, and on the other for upgrading or continuing education. But to what extent would that simulator at Linthicum Heights be available for training academy cadets and under what terms? Is that something you have considered?

Captain RICH. That system which will go in effect in the spring at the request of an academy, can be programmed in such a way that the simulation requirement for an entry officer in certain aspects of ship handling and navigation can be programmed for him.

Mr. PANSHIN. I intended to ask more of a logistic question. Would you expect that the simulator would be available or could be made available to academy cadets?

Captain RICH. Yes.

Mr. PANSHIN. Thank you.

Mr. Mason, I realize that your school is not involved in training licensed deep sea officers. Nonetheless, you are training seafarers. Your school has a great deal of experience in this regard as you do personally. Your testimony is very helpful, because it deals with the larger issue, and I do have a couple of questions.

You have stated in your testimony that with respect to simulators, the simpler the simulator, the more it is used and the greater the training value.

From the experience that you have acquired with a variety of simulators at the Harry Lundeberg School, why is this so?

Mr. MASON. Probably the main thing is the instruction utilization of it, and by the instructors being interested in it and seeing the importance in it, then the students likewise take great encouragement from them to use the thing.

We have found that the more sophisticated the system is, the greater the chance of breakdowns and down time is on it, and with the state of the art being what it is in simulators, and constantly changing, that the simpler the piece of equipment is, the longer lived it is going to be in the classroom and in its educational usage.

Mr. PANSHIN. Thank you.

To what extent do you find simulators to be a useful training device before the seafarer has had extensive at-sea experience, for initial training?

Mr. MASON. Well, we hardly use it at all for the entry people going out. Once the operators have the necessary time, we have

found it to be a very good tool to prepare them for some of the characteristics they will be up against out at sea, it is important, but until they have that initial experience at sea, I think it is hard for them to relate just exactly the points that the simulator is trying to get across. All of our people who go through the school are coming to us with the necessary time. When that simulator is used with them, I think as an educational tool, and that is all I say a simulator is, it is just an extension of an educational tool. When it is used in that framework, it is a very good tool. When it is used just as a grand display with a lot of flashing lights and a lot of movement around and a lot of different little things, many times it has more of a toy atmosphere to it.

Mr. PANSHIN. Do you have any toys at Piney Point?

Mr. MASON. We have a lot of toys.

Mr. PANSHIN. You also commented with respect to vessels, that you found smaller vessels to be more useful. What is it that makes the smaller vessel more useful for the training you are conducting?

Mr. MASON. Probably the crew situations. We are talking about tugs at Piney Point. Once you get the basic crew, everybody gets immediate hands-on; everybody gets the feeling of the actual on-the-job training that is taking place with the training vessels it is a rapid progression. One minute the man is working on the barges or in the engine room, then the next time he can be up at the wheelhouse. So it is a constant ongoing thing. There are not a lot of time and motion lost because there is one person on it and somebody is waiting a turn.

Mr. PANSHIN. A couple of the components you see as advantageous are more economical cost of operation to you and decreased crew size; in addition, a superior form of sea training for your students in terms of the immediacy, intensity and quality of training could be achieved.

Mr. MASON. I think any of us would appreciate being in a student body of say 10 to 14 people on a vessel and having the instructors dealing with it all the time rather than being 1 of 300 or 400 people. You feel more realism. You feel without the work I am doing, whether training or not, this thing probably could not get away from the pier. Everybody is using the ratchets, somebody is on the radar—they actually become a part of the crew, not just a student.

Mr. PANSHIN. Captain Rich, in terms of the increased sea training at academies, what sort of a mix of commercial ships, training ships and smaller vessels would you see as being preferable?

Captain RICH. I would be comfortable getting a young man on a ship who has had a 50–50 ratio of practical and shore side academic in-class and time at sea. In reference to the seatime, if we could have the best of all worlds, I believe I would like to see that young man have, if he is a schoolship type of fellow, 25 percent on his own schoolship and 25 percent in the commercial real world. He needs both to become the complete officer.

Mr. PANSHIN. Let me see if I understand the percentages. Half the total sea training on a training ship and half on a commercial vessel.

Captain RICH. Yes.

Mr. PANSHIN. What roles would you envision for a smaller vessel?

Captain RICH. I envision him spending most of his time in deep sea ships because that is where he is going primarily when he comes out.

Mr. PANSHIN. Do you have any recommendation or opinion as to how much of the 1 year might be satisfied by time on smaller vessels?

Captain RICH. Right off the top of my head I would say 2 or 3 months would be of value, not only in his training but in satisfying skills he could develop in that mode.

Mr. PANSHIN. Thank you. Does minority counsel have any questions?

Mr. LOSCH. No.

Mr. PANSHIN. Thank you both. You have brought a different kind of experience to the subcommittee.

I would like to call the next panel at this time.

STATEMENTS OF DONALD G. BROWN, MANAGER, MARINE AND INDUSTRY COORDINATION, MARINE DEPARTMENT OF GULF TRADING AND TRANSPORTATION CO., A DIVISION OF GULF OIL CORP.; AND VICE ADM. PAUL E. TRIMBLE, USCG (RETIRED), PRESIDENT, LAKE CARRIERS' ASSOCIATION

[The statements follow:]

PREPARED STATEMENT OF DONALD G. BROWN

Mr. Chairman and Members of the Subcommittee, I am Donald G. Brown, Manager, Marine & Industrial Coordination, Marine Department of Gulf Trading & Transportation Company, a Division of Gulf Oil Corporation, and would like to thank you for this opportunity to appear before you to express our comments on the effect of IMCO Standards on maritime education and training as well as Gulf's policies and procedures.

I made comments before this Committee on December 11, 1979. I would like to emphasize at this time that, as an owner and operator of tankers under the U.S. flag, we place a high priority on obtaining the best in maritime personnel. The "best" in this case is the well trained professional, whether he is deck or engine.

Admiral Benkert of AIMS testifed in December of 1979 on the impact of the revised standards of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978. The requirement under Regulation II/4/2(c), impacts on the officer who is to be in charge of navigational watch and his training and qualifications prior to obtaining his first license. The question is, how does the cadet or apprentice obtain the additional period of ". . . bridge watchkeeping duties under the supervision of a qualified officer; . . ."? The present Academy or State facilities' programs do not provide adequate time on board actual merchant vessels. In today's economic climate I am not sure that even a training ship will give this kind of experience (the Maritime Administration has been reluctant to cover increases in the cost of fuel to operate the training vessels).

I would like to emphasize that basic training at this stage of the licensed officer's career is very important, and we feel strongly that as much "hands-on experience" as possible is necessary. Great emphasis must be placed on actual sea time in the real environment and in emphasizing vocational professional training rather than the academic education.

This may be accomplished by:

1. Sponsoring a national training vessel in the sense of the European approach, such vessel for the joint use of Kings Point and the State schools, or

2. Expand the sea program using all the ships available under the U.S. flag, and include tugs and other vessels where practical training can be obtained, or

3. Recognizing that there are not adequate berths available within the U.S. fleet, a positive solution would be to utilize foreign flag vessels owned and operated by a U.S. company. Gulf uses this procedure with cadets from Southern Maine Vocational Technical Institute (SMVTI) under supervision who are placed aboard one of our Liberian flag vessels for part of their seagoing training, or

4. If a particular third mate has not had sufficient prelicensed supervision, he could be termed a "limited" third mate. In this capacity, he could not be in charge of a navigation watch until he can complete sufficient bridge watchkeeping duties under the supervision of a qualified officer. (This may not be ideal as many ships are not organized in this manner; and it would add to the time required in order for him to sit for his next higher license), or

5. Emphasis should be placed on acquiring as much "real" experience as possible during the cadet training period. Simulation certainly is useful in broadening the skills already acquired by the more experienced officer, and has limited application to the cadet.

We must maintain flexibility in choice or mixes of training procedures, and simulation should not become a mandatory training requirement on any level.

As I have indicated before, Gulf maintains a vocational type training program to develop third mates and third engineers in cooperation with SMVTI. This is a three year program with an absolute requirement of 365 days on board of supervised training. This is done in groups with a training officer aboard our Liberian flag vessels during the first period at sea; and then subsequently for the second and third periods in a normal cadet program aboard our U.S. flag vessels. Our program has been in existence since 1974, and we feel that it has turned out the type of trained professionals that we require in the industry today.

In conclusion, the industry must have, and we as an individual company require, an overall training program that develops a high standard of professionalism and this can be done by giving the novice or cadet as much practical hands-on experience as possible. Also, such a program must be economically supportable by the industry. If the industry is not able to do so, then we have taken the wrong approach and better go back to "ground zero" and review the whole procedure. Our SMVTI program has been successful in meeting Gulf's requirements.

PREPARED STATEMENT OF VICE ADM. PAUL E. TRIMBLE, USCG (RET.), PRESIDENT, LAKE CARRIERS' ASSOCIATION

Mr. Chairman and Members of the Subcommittee, I am Paul E. Trimble, President of Lake Carriers' Association, representing domestic bulk carriers on the Great Lakes. Cargos include iron ore for Great Lakes steel mills in Illinois, Indiana, Michigan, Ohio, Pennsylvania and New York; coal for power generation; grain from midwestern farms; limestone, cement, sand and petroleum products.

Those of us involved with lake shipping are pleased that your committee is pursuing the important matter of sea training, not only in the light of proposed IMCO standards, but also, we hope, in the interest of productivity and cost. Presumably the proposed standards are to improve safety and minimize pollution at sea and in ports worldwide, and especially in U.S. waters.

We have no argument with the IMCO objectives, but we are concerned with the means of achievement. One way or another, the proposed standards require MORE sea time for trainees. We are not at all convinced that more sea time and, concomitantly, increased cost necessarily mean increased capability attainment. Sea time is an indicator of exposure but not a measure of experience by any means.

While we aggressively support the benefits to be gained from improved training, we believe the need is for an improvement in quality rather than quantity. More sea time does not necessarily improve the quality of the training. If more sea time is required, what will be the cost not only in dollars, but more significantly in the reduction of other training which may in fact be more beneficial than the sea time gained.

As we see it, there are four major training approaches presently available. Each has its benefits and shortcomings. The four are on the job training aboard an operating vessel; practical training aboard a training vessel; classroom training; and training through the use of simulators.

On the job training aboard an operating vessel is beneficial in that the trainee is exposed to the true operating conditions faced after completion of the training. He is exposed to the actual shipboard environment, including the equipment configuration, the functioning of the shipboard team and the everyday working relationships of the crew. While cost beneficial, this approach, even for the present level of sea time required, has drawbacks:

(1) The trainee is an observer, thus hands-on experience is extremely limited.

(2) Practical experience varies from watch to watch and vessel to vessel, depending upon the whims of individual officers.

(3) The training benefits are dependent upon the desires and skills of the individual officers with whom the trainee stands watches.

(4) The number of berths available is limited and decreasing as large vessels replace smaller ones, and the current trend towards individual berths for unlicensed crew members, which further reduces berths available for cadets.

(5) There is no flexibility to provide berths for expanded academy enrollment, or the increased sea time that the 1978 IMCO Convention could require.

(6) It is not practical, and in fact may pose a hazard, to introduce bridge or engine room emergencies or casualties into the sea program.

Training ships are excellent for sea training, both deck and engineering, but can we or should we afford this luxury at each maritime academy, considering the capital cost, maintenance and operating expenses, use of scarce energy supplies and the training achieved for the time spent?

Classroom training provides the trainee with a directed course of study under the supervision of a skilled instructor. For training in the theory of shipboard equipment operation and skills, this method is excellent. For hands-on practical experience, classroom training falls short of other means though it can be supplemented with exposure to laboratory equipment.

Simulator training is the newest method to arrive on the scene. Simulators were developed in the late 1930's and the Link Trainer was a major aid in the training of the large number of aircraft pilots in World War II. During that same period the anti-submarine attack teacher provided excellent simulation training for shipboard personnel involved with convoys or patrolling against submarines. As the aviation industry has found, simulators are an outstanding training device and the FAA certifies pilots, in large measure, on the basis of simulator performance under test conditions not feasible with various passenger aircraft models. The safety records of our nuclear submarines and the man-on-the-moon project are attributable in no small measure to the simulator training of the operating personnel and the astronauts.

The use of simulators permits the trainee to gain the experience of coping with a multitude of emergency conditions and equipment failures without the risk of loss of life or destruction of equipment should his response be improper or untimely. The trainee is given immediate feed-back on the results on his actions and the opportunity to discuss his solution with a skilled observer. The casualty condition can then be recreated in order that the trainee can repeat the exercise and modify his actions based upon his learning experience.

Coast Guard marine accident statistics show that over 75 percent of marine casualties are people-related. To me that is a positive indication of the need not only for better training, BUT also for a better means of measuring the qualification of an individual before a license is issued. Performance can be tested under conditions not feasible with a real vessel.

We feel that optimum training requires a proper mix of professional instruction, shipboard experience and experience in emergency evolutions within a reasonable time period. No single training method is cost beneficial in providing such a mix. This is the basis for our continuing entreaty to Congress to authorize the furnishing of electronic simulators, bridge and engineroom, to state or regional maritime academies in lieu of training vessels where appropriate. Such authorization will facilitate the programming and budgetary process for the Administration. The presence of such equipment will provide the Coast Guard with means in that area for realistic testing before licenses are issued or upgraded.

Mr. PANSHIN. Mr. Brown, would you present your summary at this time, please.

Mr. BROWN. I appeared here earlier in December to make certain comments, and I appreciate the opportunity to return. As a member of industry, I am concerned with the capability of the officers Gulf employs and particularly the third mates operating as new officers. Much of what has been said I agree with, no doubt about it. This additional requirement, I would like to summarize, maybe could be satisfied, and I will say our emphasis is hands-on experience for an apprentice or trainee. The European approach to a training ship might be looked at. Admiral Rodgers indicated there are other types of approaches in this matter: emphasis not so much on the use of tuition but any of the vessels within the U.S.-flag fleet that would give good prelicense experience; knowing there are not adequate berths onboard, the utilization of foreign vessels owned and operated by a U.S. company—Gulf uses this

procedure from our technical study under the supervision of an instructor. Cadets are placed onboard for a portion of their seagoing requirement.

In the conditional third mate, if he has not had the sufficient amount of prelicense time, then he obtains this after he has been given his license with a condition.

Ultimately, there is a place for the use of a computer or simulator, but this has to be worked on. Flexible alternatives should be maintained. We feel no one area should be mandatory, excluding other areas and there should be, again, a mix or substitutions or mix of equivalencies.

The other questions could have it. Can the Government or industry afford this kind of expense? These type of training aides that I am talking about, the computers or simulators, quickly become redundant and a $5 million investment makes a training tool an albatross on the training institution. I think indirectly of Gulf's approach through our program with South Maine, we have a 365-day requirement of actual seatime. This is done basically in three periods. The first is on board basically our Liberian-flag vessels with an instructor. Then the other two periods are done aboard U.S-flag vessels in closely supervised programs with the present officers on board. We also participate with Kings Point in their cadet program. Basically I do not think the cadet on board is an observer. I feel he is a participant and is supervised while on board. This may not be the general case, but as far as Gulf is concerned, it is.

Mr. PANSHIN. Mr. Brown, thank you for your testimony. I do indeed remember your being here last December. Your comments were helpful then as they are today.

I would also like to welcome back Admiral Trimble.

Admiral TRIMBLE. Thank you. I will offer my statement for the record in the interest of time. We have heard the pluses and minuses of the various training tools for embryonic ship board officers, that is, training ships, cadet seatime on commercial vessels, and simulators and I think it has been very well covered. So I will confine my comments to our problems on the Great Lakes.

On the lakes, our academy does not have a training ship, it uses small craft and is installing a radar simulator. The seatime for cadets is gotten by using berths on board commercial vessels. That leaves much to be desired particularly since the number of berths is decreasing on lake ships so we will not be able to handle the cadets at our own academy plus those we are asked to handle for Kings Point, Maine, and some of the other coastal academies. I recognize that seatime on board commercial vessels is probably the poorest of the three different methods of training but nevertheless that is what we have and it does offer a form of practical training. I feel very strongly that simulators will enhance training considerably as far as seaboard officers are concerned.

It has been said and we are well aware that the IMCO convention does not apply to the Great Lakes. I was interested to hear the Coast Guard witness say they are not planning at this time to apply the convention to the Great Lakes. That is very helpful, but that is at this time. The trend has been where some standard has been put into effect, to start applying it universally. We should not

be lulled into a false sense of security because we can expect to contend with the standard at a future time. Besides, if the standard is good and valid, it should be applied to the Great Lakes. I think the objective is good but I do not think the method of achievement is sound.

Thank you.

Mr. PANSHIN. Thank you.

You responded in the latter part of your summary to one of the questions I had, and that was since the IMCO convention did not apply to the Great Lakes, why then are you such a strong advocate of simulators. You answered that in part but I think there is still a question. Let us say there was no IMCO convention at all. What would be your position on simulators?

Admiral TRIMBLE. We need simulators. We do not have enough sea berths and we think this is a better training tool.

Mr. PANSHIN. Is it because of the decrease in berths or because there is a superiority in simulator training?

Admiral TRIMBLE. I think there is superiority in simulator training.

Mr. PANSHIN. What are the areas of superiority in simulators?

Admiral TRIMBLE. It has been pretty well summarized. Simulators can introduce all sorts of operating situations, emergencies that cannot be reproduced on ship as far as a commercial vessel is concerned where time is dollars as far as the commercial vessel is concerned. So, they are not going to be able to have time to spend to set up various operating situations for the student to test and look at. Moreover, they do not have a faculty member from the academy to supervise. So it is whatever interest and capability the officer on the watch has at that time which can vary from a lot to almost nothing. So, as far as that kind of training, I do not think much of it. But as far as the kind of training you can introduce and reintroduce timewise with a simulator—the student can see in a briefing recap what he has just gone through and see what he has done wrong. You can set it up again and go through a similar problem for him to see if he has learned from his mistakes.

So, timewise, we are talking about a matter of minutes to reset the problem. You can set up situations on a channel, potential accidents, collisions, groundings, but you cannot reproduce these in the real world as far as shipboard experience on a commercial vessel is concerned.

Mr. PANSHIN. So where you see advantages to simulators is as an extension of what Admiral Rizza has come out in favor of, a program for the initial license which is almost totally comprised of simulation.

Admiral TRIMBLE. I see that coming down the pike, he said 10 to 15 years, I believe it, but I do not think we will achieve that with the conservatism we have just heard in the Coast Guard.

Mr. PANSHIN. What role do you see for commercial vessels?

Admiral TRIMBLE. I see them still being used but to a lesser degree. This gives the student an opportunity to see the real world, to be a part of the shipboard atmosphere, dealing with the licensed and unlicensed personnel. He would not have that experience on a simulator. So the shipboard life, rolling, pitching, adverse weather, being away from home, that experience he would not get with

simulators. So, some small portion of his time could still be spent on a commercial vessel.

Mr. PANSHIN. Would you so recommend?

Admiral TRIMBLE. Yes.

Mr. PANSHIN. In the context of the 12-month requirement, how much time within that 10- to 15-year period which you predict as a minimum amount of time to meet the requirement should be spent on commerical vessels?

Admiral TRIMBLE. No more than 15 percent; 85 percent on simulators.

Mr. PANSHIN. From the outset of my contact with you last fall, you have been a very clear and consistent spokesman in favor of simulators. I think every time this subcommittee has heard from you, your testimony has included comments regarding simulators. Some of my questions are redundant, but we want to offer the other people the opportunity to respond, Mr. Brown, to the question of simulators as contrasted with commercial ships for training.

Mr. BROWN. I would like to emphasize, the cadet or trainee, third mate, has to deal with the real world, as the Admiral mentioned, you cannot simulate life on board a ship. While the simulator has tremendous capacity for variances and immediate changes, we feel there is not a substitution for the actual physical experience that is necessary. As I said before, it can be used, it is an excellent tool. I am not opposed to the use of simulators, I am opposed to their emphasis lest ultimately they become mandatory. This is my concern. I feel there should be a conservative approach to look at all avenues. Something should not be closed out or restricted. Who knows what might be around the corner tomorrow which will serve as a training approach?

So a simulator has a role in training——

Mr. PANSHIN. Without making simulators mandatory, in your prepared remarks you indicated simulator training has limited application for cadet training. Can you elaborate on that? If we are looking at this 12-month period of time, how much time should be for simulator training and what kind of use do you foresee for simulators?

Mr. BROWN. About 15 to 20, percent and this would be enhancing the skills already developed or creating the environment that normal shipboard practice prevents, such as the emergency, or conditions which you would not particularly want to submit a vessel to, stress conditions under poor loading or as I say, emergency stranding, collisions, this type of thing.

Mr. PANSHIN. As part of the total training?

Mr. BROWN. Right.

Mr. PANSHIN. To what extent are you in favor of the use of smailer vessels for training at cadet academies?

Mr. BROWN. I am not opposed to any vessel giving a cadet an opportunity to learn good techniques, line handling, whatever. Somebody said earlier, any experience gained is of value. I think in some cases—I think Bruce McAllister emphasized it—the ability to handle a towboat or tugboat is a tremendous asset. Projecting that to the shipmate or captain is a great advantage. The third mate is not a ship handler. He is the lowest man on the totem pole. He is

not even an AB in that sense because he does not have that kind of responsibility.

Mr. PANSHIN. Thank you. Admiral Trimble, back to you. The Lake Carriers' Association has been actively involved with the Great Lakes Academy in a variety of ways. In terms of simulators, what sort of support might the Carriers' Association be considering to provide to that Academy?

Admiral TRIMBLE. Well, we have assisted in getting the radar simulator which will be installed this year. We have been assisting insofar as expansion of the Academy is concerned, both financially and in used equipment, something taken off one ship and not reinstalled, such as radars, generators, pumps.

Mr. PANSHIN. Have you had any discussion with the Carriers' Association as to a simulator?

Admiral TRIMBLE. We have had considerable discussion but nothing in a tangible way as to how far we will go. We have trimmed down fairly substantially. We have a commitment now for 4 years of support.

If training vessels can be provided to academies by the Government, simulators should be offered as an alternative. As long as the United States is furnishing a training vessel, is it unfair that a simulator be provided as an alternative? It seems to me that is equitable and a substantial savings to taxpayers.

Mr. PANSHIN. Your argument is persuasive.

If there were a simulator at Great Lakes Academy, would your members be interested in using it?

Admiral TRIMBLE. Yes, companies are interested, they are sending people to various simulators now including over to Lake Grenoble in France. We have been, for several years, sending officers to simulators for training.

Mr. PANSHIN. One final question. You mentioned the situation on the Great Lakes, with the decreasing number of ships and therefore decreasing number of berths. Has any consideration been given to providing more berths for cadets per ship? Is that a possibility? What are the prospects for this?

Admiral TRIMBLE. The chances of providing more cadet berths per ship is not very good because the trend is for furnishing individual rooms to unlicensed personnel. That will depend upon the labor management agreements, but it detracts considerably from the berths that will be available for cadets.

Mr. PANSHIN. So it is really a dynamic situation but one where you do not see the future prospects as being favorable?

Admiral TRIMBLE. That is correct. Particularly with the possibility of more sea time being required.

Mr. PANSHIN. Mr. Losch?

Mr. LOSCH. I would like to find out a little bit more about your using the foreign flag vessels for training. Do you have a U.S. officer riding on those vessels to provide supervision?

Mr. BROWN. Yes, a group of cadets go with a certified, licensed instructor. This is in accordance with Coast Guard requirements.

Mr. LOSCH. How many cadets are on the vessel?

Mr. BROWN. The classes are about 20, so it is about 10 cadets and 10 engineers.

Mr. LOSCH. On one vessel?

Mr. BROWN. Our Liberian-flag tankers. Those are the vessels we have today operating from east Africa to the gulf coast of the United States.

Mr. LOSCH. But you have up to 20 additional passengers.

Mr. BROWN. We are up to 20, basically, we are doing it in units often. Again, it is a question of space. These particular ships have the space.

Well, in two of the ships in the fleet they were built, they are now 20 years old, and were built originally for 55-member crews, and they are down to 35-member crews plus there was a lot of space on board because you had midship's house and after-house but in today's economy of building everything back-aft, yes, you are building smaller quarters.

However, the particular quarters that are on several of our vessels have sufficient space.

Mr. LOSCH. The reason I am raising this point is that one of the alternatives mentioned to train additional cadets on oceangoing vessels would be to double up, triple up on existing commercial vessels, but the problem of space and accommodations has been voiced.

When you put these additional people on these vessels, are you putting more than one or two to a stateroom, or do you put additional berthing accommodations in the existing staterooms?

Mr. BROWN. The quarters basically have two men to a stateroom.

Mr. LOSCH. It is just that these particular vessels have the additional space?

Mr. BROWN. They have the space available, and there are classroom facilities. There is enough space onboard to carry out this program.

Mr. LOSCH. On your U.S.-flag vessels, do you think that a similar doubling up of accommodations could be done?

Mr. BROWN. There is not basically enough space. We would use the U.S.-flag vessels if we could. The cadets go on in groups of two or four when they are farther along in their program, and then they carry out their sea project under the supervision of the ship's officers, and close supervision from the school.

Mr. LOSCH. Thank you, Mr. Brown. Thank you, Admiral Trimble.

Mr. PANSHIN. Thank you both for your testimony.

Admiral TRIMBLE. Will you thank the chairman for permitting the hearings to continue? I think that was very considerate.

Mr. PANSHIN. I will, indeed. The alternative was that we might not have been able to reschedule this hearing at an early date. Mr. AuCoin still does hope to return, but we are reaching a point in this Congress where each day is extremely busy.

The next panel is Captain Muth, American Waterways Operators, and Captain Mayberry of the Offshore Marine Services Association.

Again, we are welcoming back two from whom we have heard before, and I appreciate your returning and addressing the subcommittee on today's subject.

Captain Muth, may we receive your summary first.

STATEMENTS OF CAPT. HAROLD MUTH, VICE PRESIDENT OF GOVERNMENT RELATIONS, AMERICAN WATERWAYS OPERATORS; CAPT. WILLIAM MAYBERRY, EXECUTIVE DIRECTOR, OFFSHORE MARINE SERVICES ASSOCIATION

[The prepared statement of Captain Muth, the American Waterways Operators, follows:]

PREPARED STATEMENT OF CAPT. HAROLD MUTH, VICE PRESIDENT OF GOVERNMENT RELATIONS, AMERICAN WATERWAYS OPERATORS

Mr. Chairman, the American Waterways Operators, Inc. appreciates this opportunity to testify on the very important matter of sea training for Federal and State maritime cadets.

While it is generally accepted that graduates from Kings Point and the State maritime academies will normally go to sea in large ocean-going vessels of the U.S. merchant marine fleet, we believe that the alternative to employment and career opportunities offered by the towing industry and other small vessel industries, such as the oil exploration industry, should receive greater attention.

For example, there are in excess of 4,000 towing vessels plying 25,000 miles of U.S. navigable waterways as well as the coastal waters of the U.S. Besides performing the many tasks required in harbor operations, this fleet of towboats moves more than 650 million tons of cargo annually. This represents two-thirds of all domestic cargo tonnage moved on water.

We quote the above figures to illustrate that the towing industry can be rightfully considered as an important element of the total maritime picture.

During the subcommittee hearings on H.R. 5451 we testified on the availability of vessels within the towing industry for purposes of the training of maritime cadet. It was our hope that this resource for cadet sea training be better exploited by both Federal and State maritime academies. While our efforts did not produce completely satisfactory results, the language in sections 1303(f)(2) and 1304(c)(3)(A)(ii) of that bill does spell out the opportunity for such training.

We would have preferred to see some language which would encourage the training on small vessels i.e., such as the granting of creditable time toward a third mate or engineering license. Without this type of encouragement or reward we cannot see much hope for an increase in enthusiasm on the part of cadets.

The training offered by sailing on towing vessels and supply boats will give cadets greater exposure to (1) piloting in restricted waters, (2) maneuvering in confined and congested waterways or harbors, and (3) towing operations including hawser towing, towing in the notch, and flotilla towing in the pushing mode.

Additionally, the handling of cargos by boom dereks, or cranes: the use of wire, manila, and nylon ropes in cargo handling, mooring, and unmooring; the launching and retrieving of small boats and life rafts; and the dropping and weighing of the anchor are routine chores that are experienced almost on a daily basis.

It is not our intention to detract from the importance of cadet training on board the ocean-going deep-draft vessels. Nor is it our intention to cast any doubt on the importance of maritime academy training vessels. We firmly believe that those important elements of sea training should be maintained and enhanced wherever practical by use of large ship simulators and collision avoidance systems. We would, however, like to point out that the training opportunities offered by small vessels not only compresses a great amount of activity and diversified tasks into a short time frame, it is also done under an arrangement whereby the cadets receive tutoring on an almost one-to-one basis.

We have some self-interest in representing this testimony. We desire to attract more graduates of Kings Point and the State academies into our industry. All too often these individuals come into the industry in middle management positions after serving on deep sea vessels and have little or no practical experience on towing vessels. Therefore, their talents and abilities in management are somewhat hampered by this missing experience.

It might be worthy to note that the U.S. Coast Guard Academy has in recent years adopted a summer program for cadets whereby a small number (four to six) receive approximately six weeks of training in the towing industry. This includes on board time on tows that ply the Western Rivers.

Also, the American Waterways Operators, in a cooperative effort with the Coast Guard, provides training for three or four Coast Guard junior officers each year through a four month industry training course.

Both of these programs are highly successful and contribute toward a better understanding of the industry operations by the Coast Guard officials.

In summary we support H.R. 5451 as passed by the House but would like to see some language added to it when it reaches the Senate which would provide an incentive to the cadets to train on small vessels. We believe the language should specify that training time would be creditable toward the license required under sections 1303(g) and 1304(g)(3)(B).

We thank you for the opportunity to testify and we will be pleased to answer any questions you might have.

Captain MUTH. Thank you.

It is a pleasure to be back here again. I think I will let my statement stand the way it is written without going into any summary if it is all right with you. There are two points I would like to address in it.

One is our comments regarding our previous testimony on H.R. 5451, whereby we expressed the desire to get some language into the bill which would give credit to time served on small vessels toward the license that the cadets receive upon graduation.

Mr. PANSHIN. And from what we have heard earlier today from the Coast Guard, it looks as if they may be induced to allow some time for that purpose.

Captain MUTH. I was pleased to hear everybody kind of get on board the bandwagon as far as the valuable training that can be obtained on small vessels is concerned, but I would just like to point out to the subcommittee that there is a regulation in force which prohibits crediting this time toward the license that the State academies and Kings Point graduates get.

It is contained in 46 CFR, subpart 10.05-33, and the appropriate language says, "In order to be eligible for an unlimited ocean license, an applicant must have obtained his service on ocean or coastwise vessels of 1,000 gross tons or over." So unless this regulation is changed, we see little hope in the way of encouraging the cadets to serve on the smaller vessels.

The word comes back to us that they are reluctant to do so at this time because of this prohibition.

Mr. PANSHIN. My understanding of the equivalency package, and from Admiral Bell's comments, is that as the IMCO convention is implemented, Marad and Coast Guard are considering just that kind of change.

I wonder if either Marad representatives or Coast Guard representatives in the audience would care to respond to that point for clarification at this time.

Mr. Friedberg or Commander McCowen, could you speak to that?

STATEMENT OF MR. ARTHUR FRIEDBERG, DIRECTOR, OFFICE OF MARITIME LABOR AND TRAINING, MARITIME ADMINISTRATION

Mr. FRIEDBERG. I am Mr. Friedberg, Maritime Administration. I think you have expressed what Admiral Bell said. That is that, obviously, as innovations or changes are acceptable to Coast Guard and to Maritime Administration, the appropriate changes would be made in the regulations.

Mr. PANSHIN. Commander McCowen, do you wish to speak to that point?

STATEMENT OF COMDR. S. D. McCOWEN, CHIEF, MERCHANT VESSEL PERSONNEL MANNING BRANCH

Commander McCOWEN. No further than what I have said.

Mr. PANSHIN. Will you please identify yourself?

Commander McCOWEN. S. D. McCowen, Chief, Merchant Vessel Personnel Manning Branch.

I would just like to reiterate Mr. Friedberg's statement.

Mr. PANSHIN. Which is that the Coast Guard is, in fact, considering that kind of change?

Commander McCOWEN. It would be one of the considerations for the implementation of the convention.

Mr. PANSHIN. Captain Muth, we will pursue that in written questions to seek that clarification.

Excuse me for the interruption. I do understand the point you are making, and would you proceed with the rest of your summary?

Captain MUTH. That is most heartening, and I will accept that, and look forward to these changes.

Mr. PANSHIN. I am sure you will.

Captain MUTH. The only other comment I have about the testimony that I submit for the record is the misspelling of the word "derrick." I think my secretary knows more about shapely movie actresses than she does trains and cargoes. That is on page 2. Otherwise, I would be pleased to answer any questions you may have about the paper itself.

Mr. PANSHIN. Thank you.

Before proceeding with the questioning, Captain Mayberry, may we have your summary?

STATEMENT OF CAPTAIN W. A. MAYBERRY, EXECUTIVE DIRECTOR, OFFSHORE MARINE SERVICE ASSOCIATION

Captain MAYBERRY. Yes. Thank you, Mr. Panshin.

Mr. PANSHIN. You are welcome.

[The prepared statement of Captain Mayberry follows:]

PREPARED STATEMENT OF CAPT. W. A. MAYBERRY, EXECUTIVE DIRECTOR, THE OFFSHORE MARINE SERVICE ASSOCIATION

Thank you. I am Captain W. A. Mayberry, Executive Director of the Offshore Marine Service Association, which represents the owners and operators of supply boats, crew boats, tugs, lay and bury barges and other equipment that operate in support of offshore oil development. The industry operates over 3500 American flag vessels and provides employment for over 30,000 American seamen.

The Association is pleased to have this opportunity to testify before the Ad Hoc Subcommittee on Maritime Education and is more than pleased that this Ad Hoc Committee has the foresight to examine the impact that the International convention of Standards of Training, Certification, and Watchkeeping 1978 will have on the American Merchant Marine before it becomes a fait accompli.

We would hope our comments will prove to be constructive. However, by commenting it must not be construed that the Association or the industry it represents supports the ratification of this instrument in its present form. If accepted as drafted, it will grievously change our present national practices and affect not only the offshore oil industry, but all small vessel interests.

Our examination of the convention leads us to the conclusion that the convention is seriously flawed. Despite the strictness of wording as to sea-service and training requirements, certain vested interests incorporated vague language that will afford them special latitudes to depart from the terms of the convention. Whereas the policies of the United States would not condone such pratices nor is our present fleet's tonnage within the affected area, it is an example that illustrates an imperfect instrument. Further and more importantly, we believe that the difference of sea

service and training requirement established by the convention for the Deck Officer versus the Engineering Officer could certainly discourage entry into the engineering field. This unequal treatment is a departure from our present national practice where sea service and scope of examination afford both departments equal opportunities for advancement.

Mr. Chairman, you and the members of the Ad Hoc Committee must realize that it is difficult to testify before you as to what effect the convention will have on sea training. Few organizations that will testify today can be certain how the convention will affect their operations, training programs, or their personnel. Nor is it clear if there are sufficient manpower resources or if there is sufficient interest or motivation for young persons to consider sea going careers. Until the Coast Guard makes the proposed regulatory implementation available, the Congress, individuals, and organizations can only guess as to the potential economic impact. Even the mechanics of compliance with the convention is unclear, but it is clear that industry must know how the Coast Guard will interpret the convention before they can make their final judgment as to whether or not they should support ratification.

Some of the issues that must be resolved prior to ratification, and that will impinge on any sea-training follow:

Can it be predicted when the convention would enter into force internationally? Should less than 25 nations sign the convention, what would be the position of the United States? Would the United States implement all or parts of the convention party to its entry into force internationally? Will the United States continue our present national practice for five years after the entry into force? Will the United States grandfather seafarers under the transitional provisions of Article VII? And if so, what categories of seafarers would be involved? Under Article IX will our Administration adopt other educational and training arrangements? Would these other schemes reduce the sea-service requirements of the convention? Can they? How will the United States define near-coastal voyages? What material will be excluded from the examination for ships serving on near-coastal voyages? Can or would the examination be varied? Will the Administration consider the ship's size and conditions of the voyage to vary the sea service and minimum knowledge requirements? Will the United States eliminate the position for First Assistant Engineer or run a dual license system? What will be the status of the Motorboat, Towing, and Ocean Operator licenses? Will vessels presently operating without licensed engineers be affected? Vessels with only Chief Engineers? Vessels whose present complement is Master or that of Master and one, two or three Mates (no Chief Mate or Second Mate)? The convention permits the substitution of a period of special training for not more than two years of the required three years sea going service (in other categories of licenses, the special training includes an adequate period of sea going service). What is "adequate" and what will "special training" entail? After receiving a license as a deck or engine officer, will further special training serve to reduce or substitute for sea service for advancement? The tonnage parameters used throughout the convention will be effected, for certain classes of vessels, when the International convention of Tonnage comes into force. How will the convention be applied to new construction with vastly higher gross tonnage? Although new equipment will be admeasured at higher tonnages, the vessels will be identical in length, power, and service. Must they, should they, can they be treated as similar existing equipment?

Although training or plans for training programs will be influenced by this litany of questions, it is quite clear the convention orders more sea service for most categories of licenses. For the State and Federal Academies the requirement for approved sea service of one year changes the present most acceptable requirement of 6 or 9 months. For the offshore industry, a seafarer presently under national practice requires 3 years sea-service to become a master under one system or 4 years following the traditional (3 year for mate and an additional one year for master) system.

The convention extends the sea service for Master serving on vessels of 200 gross tons or more to six years.

Although uncertain of the Administration's position there are several clues as to their thinking. Some would offer promise and some appear discouraging. There is enclosed in this statement a comparison chart of sea service for licensing requirements in the offshore marine services industry. This chart, which purports to compare present sea service requirements with that of the convention, was prepared by the United States Coast Guard for Congressmen and Senators who have equal concern as to the impact the convention might have on the American merchant marine. We cannot apologize for the chart, but an expert on the convention would have difficulty interpreting these comparisons. However, it does appear that the Coast Guard contemplates substitution of approved training for sea service and that

one month's training could serve as a substitute for 3 months sea service. It appears equally clear that one year's sea service is required as a minimum and this would be equally true for Federal and State maritime academies.

An approved training course of study is a step in the right direction in that prior to this chart the Coast Guard had consistantly equated a day of training as a day of sea service. However, it is unclear how they established three for one. It is an administration prerogative, for no guidance is provided in the convention. Until guidelines or the regulations are available, we cannot comment on their decision to establish a three to one ratio. However, why not a five to one ratio or even more? Should not the course content, the instruction, the grade of license sought, the type of vessel on which the applicant would serve, lengthen or shorten the course of instruction rather than one arbitrary equation? Certainly, satisfactory completion of the prescribed examination is a measure of the training. As an aside, academy graduates completing a four year course would appear to have 12 years accredited sea service.

On the discouraging side, the IMCO Subcommittee on Standards of Training and Watchkeeping continues its work in London to establish guidelines for nations in the application of principles of safe manning. They propose, supported by the U.S. delegation, that the engineering watch consists of not less than one duly qualified engineer officer. As reflected earlier in this testimony, the convention would seem to support this premise. For over twenty five years, this industry has operated its equipment without the licensed engineer. Until the Coast Guard interprets the convention in this respect, decisions on training must be held in abeyance.

At present time, there are a number of state supported and private schools which provide training for personnel in the mineral and oil industry. This training is directed primarily at preparing applicants for Coast Guard examinations leading to licenses as Masters, Mates, and Engineers on offshore supply vessels, ocean operators on crewboats, and operators for uninspected towing vessels. The courses range in length from one to two weeks, with the students attending during their "off hitches."

Although it is difficult to determine the total yearly output of the schools, a reasonable estimate of the attendees at three institutions in Louisiana (two state schools and one private school) is as follows for one year:

Master/mate, mineral and oil candidates	500
Towing vessel operator candidates	300
Engineer candidates	100
Ocean operator candidates	500

If the IMCO standards were enforced as they are written, all these candidates would face significantly longer sea service requirements unless they completed "approved training courses." Based on information in the comparison chart received from the Coast Guard, these training courses would last anywhere from 4 to 12 months, with the attendees accumulating the total time in one month segments.

The problems which would be generated by this system of training would be enormous for the students, the schools, and the industry in general. Because most vessel personnel work a "7 on—7 off" or "14 on—14 off" schedule, attendance at a school for a month long period would deprive them of a month's wages. When these lost wages are coupled with the additional expenses of commuting, tuition, and room and board at the school, the total dollar amount of the training for one month could amount to well over $12,000. When that figure is multiplied by the four, eight, or twelve month long periods envisioned by Coast Guard proposals, the training becomes an economic impossibility for the individual.

It is also important to note that no regional school now exists to provide the "approved training" contemplated by the Coast Guard. Given the enormous outlay in capital that would need to be expanded for dormitories, instructors, and training facilities to conduct such comprehensive instruction (which so few people would be able to attend), it is highly unlikely that any existing school would be able to provide these services.

Even if there were a "magic wand" that could be waved to create the schools and subsidize the students, the fact that replacements would have to be found for the individuals in training would only exacerbate the manpower shortages now plaguing the industry. The repeated changes in crew make-up and the resultant instability would even have an adverse impact on marine safety.

If ratification of the convention mandates the need for Coast Guard approved training courses, we would submit that certain of these training courses could be tailored and approved for completion at sea, not unlike the sea-projects currently in use at the Federal academy. In this way, a candidate could, while acquiring the required minimum sea service, complete an approved course.

It should be noted that the convention is, pure and simple, a product of big ship thinking, tailored to meet the real or imagined problems of big ships. Other than the references to tonnages and horsepower thresholds, there is precious little in the convention which indicates that the drafters knew or were concerned for the peculiar problems of the small ship in the context of a big ship oriented convention. It must also be remembered that by and large, small vessels and the people who work on them comprise the major portion of the U.S. merchant marine. These people and these vessels are employed in domestic waters, coastal waters, and in substantial numbers on the oceans of the world. Their manning, operations, and physical characteristics are inherently different from the modern large cargo or tank ship as it has come to be in recent years.

Training of personnel of the smaller vessels operating in support of oil and gas production has, of necessity, become the responsibility of the companies which operate the vessels. There are no federal monies appropriated or used for training of personnel for these vessels.

Several companies operate in-house training programs not unlike those operated by the private institutions, differing in that the majority of these programs work hand in glove with the company safety programs. They too serve a purpose and are a necessary part of vessel operations.

Although the convention purports to establish minimum requirements for seafarers to bring into safety parity those unnamed foreign nations who bootleg incompetents and mismanage rusty old tankers, the convention will have far-reacting ramifications for the small commercial vessels of the United States. With the requirements of deep-sea ships serving as a model, the convention will impose these levels of knowledge and sea service on the smaller vessel. It may very well be that Coast Guard schemes of training designed to reduce sea-service will serve only to stifle one of the last viable segments of the United States Merchant Marine.

COMPARISON CHART OF SEA SERVICE FOR
LICENSING REQUIREMENTS IN THE
OFFSHORE MARINE SERVICES INDUSTRY

Ships Less Than 200 GRT

LICENSE	PRESENT	PROPOSED	
		Full Convention	Alternative Requirement
Motorboat Operator (Near Coastal Voyages)			
MASTER	12 mo.	12 mo.	9 mo. + 1 mo. training
Ocean Operator (Near Coastal Voyages)			
MASTER	24 mo.	24 mo.	18 mo. + 2 mo. training
Uninspected Towing Vessel			
2nd Class Operator (Mate)	18 mo.	18 mo.	12 mo. + 2 mo. training
Operator (Master)	Total 36 mo.	24 mo.	18 mo., 9 mo. as mate + 2 mo. training
TOTAL	36 mo.		30 mo., 9 mo. as mate + 4 mo. training

Ships 200 GRT or More and Less Than 1600 GRT

Mineral and Oil			
Mate	36 mo.	36 mo.	12 mo. + 8 mo. training
Master	12 mo. as Mate	36 mo.	24 mo., 12 mo. as Mate OR 4 mo. training
TOTAL	48 mo. 12 mo. as Mate		36 mo. and either: 8 mo. training and 12 mo. as Mate, or 12 mo. training
Freight and Towing			
Mate	24 mo.	36 mo.	12 mo. + 8 mo. training
Master	Total 48 mo. incl. 12 mo. as Mate	36 mo.	24 mo., 12 mo. as Mate OR 4 mo. training
TOTAL	48 mo. 12 mo. as Mate		36 mo. and either: 8 mo. training and 12 mo. as Mate, or 12 mo. training

ALL SHIPS LESS THAN 1600 G.T.

Mineral and Oil, Freight and Towing

	PRESENT	PROPOSED MINIMUM	
		Not on Near Coastal Voyages	Near Coastal Voyages
Asst. Engineer	36 mo. Education and training, or experience	36 mo. maritime education and training; OR 36 mo. sea service in any engineering capacity; OR 18 mo. qualified as Asst. Engineer on near coastal voyages	For ships less than 4000 HP, 18 mo. in any engineering capacity plus 6 mo. training
TOTAL	36 mo.	36 mo.	18 mo. + 6 mo. training
Chief Engineer Ships between 1000 HP and 4000 HP Propulsion	Total of 48 mo. of which 12 mo. as Asst. Engineer on such ships	Meet the requirements for Asst. Engineer on near coastal voyages and serve 30 mo. of which 18 mo. as Asst. Engineer on such voyages, and 12 mo. qualified to serve as Asst. Engineer not on near coastal voyages	Meet the requirements for Asst. Engineer on near coastal voyages and serve 12 mo. as Asst. Engineer on such ships
TOTAL	48 mo.	48 mo.	30 mo. + 6 mo. training
Chief Engineer Ships 4000 HP Propulsion and Over	Total of 48 mo. of which 12 mo. as Asst. Engineer on such ships	Meet the requirements for Asst. Engineer on near coastal voyages and serve 30 mo. of which 18 mo. as Asst. Engineer on near coastal voyages and 12 mo. as Asst. Engineer on ships of 4000 HP and over not on near coastal voyages	Meet the requirements for Asst. Engineer on near coastal voyages and serve 30 mo. of which 18 mo. as Asst. Engineer on near coastal voyages, and 12 mo. of which on ships of 4000 HP and over
TOTAL	48 mo.	48 mo.	48 mo.

Captain MAYBERRY. I think I had better just identify that I represent the Offshore Marine Service Association, which has to be construed as a significant part of the American merchant marine.

We operate over 3,500 American-flag vessels, and provide employment for over 30,000 American seamen, and we are pleased to have this opportunity to testify today, and we are more than pleased that this ad hoc committee has had the foresight to examine an international convention before it is ratified, as to what effect it may very well have on the U.S. merchant marine, before it becomes a fait accompli.

I hope our comments will be constructive, but by testifying here today, it cannot be construed that the association or the industry it represents supports the ratification of this instrument in its present form.

If accepted as drafted, it will greviously change our present national practices and affect not only the offshore oil industry, but all small vessel interests in the United States.

I think you will appreciate the fact, from the testimony received this morning, that it is difficult for any of these organizations to testify as to how they feel about the convention impacting on sea training.

I think you found them struggling in some interpretation that sought to get relief from what the terms of the convention provide. And I think a splendid example, until the Coast Guard makes the proposed regulatory implementation available, the Congress, these individuals, and our organizations can only guess as to the potential economic impact. And a splendid example is the discussion of simulators here this morning.

The Administration, the U.S. Coast Guard, and others, seek the ratification of the convention. They have said to the industry, to the State and Federal academies, "Hey, we recognize you have a problem with the language of the convention in that it requires a year's sea service as opposed to your present 6 months or 9 months, depending on the particular program." And they have said, "We are going to try and solve that by the use of simulators or the examination of some experience with small vessels," but then I can only say that I heard a lot of back and filling, a nautical term.

Then they said, "Well, in the use of simulators we have some doubts about it. We also would feel that it would have to be tailored especially into your program, and we would have to examine it."

Then we heard them describe small ships. They were pretty specific, without being detailed as to what size might be available.

Then their statement went on to say that if they find this simulator program tailored especially in the way that they saw it, in the use of the small vessels exactly as they felt it could be applied, they might, they might, I think that is the word out of the statement, feel justified in notifying the Secretary General of IMCO, because the convention demands that any departure from the language of the convention must be addressed to all the member nations.

Now, that presumes one thing. There are certain legal opinions around that article 9, that is the table of equivalencies, will not offset the language of II/4. II/4 is the minimum requirement of 1

year's sea service. There is some debate as to whether even this program that the Coast Guard is suggesting, that should the State academies apply themselves, in the use of simulators, in small vessels, that these programs might not be acceptable to the Secretariat and the other member nations.

In my statement I have listed several pages of questions, using language of the convention as we best felt that it affected training. I won't read this long list of questions, but they are drawn from the convention, and in our opinion, I cannot decide what sort of training I shall apply until I know how the Coast Guard will interpret these sections of the convention, and until they write them down in a proposed regulatory implementation, I am at a loss as to what programs I should develop or where I should go or what shall I tell my seamen.

All of these affect this, and I will skip this part because everybody is well aware that the State and Federal academies are looking for a 100 percent increase in the case of State academies in their present sea service requirements. But perhaps it wasn't clear to you, on your reading of the convention, that in the offshore industry, where the current sea service requirements for master, is presently at 3 years or 4 years, depending on what system the seaman candidate uses, the convention now will require 6 years' sea service before he can acquire the same position.

We are absolutely uncertain as to the Administration's position, but we have been provided several clues. You will note that attached to my statement is a comparison chart of sea service for the license requirements in the offshore marine service industry.

This chart, which purports to compare present sea service requirements with that of a convention, was prepared by the Coast Guard for Congressmen and Senators who have equal concern as to the impact the convention might have on the American merchant marine.

The chart is difficult to read even for an expert on the convention. However, it does appear that the Coast Guard contemplates the substitution of approved training for sea service, and that 1 month's training could serve as a substitute for 3 months' sea service.

It appears equally clear—well, that is the 1 year again for the State and Federal maritime academies. An approved training course of study is a step in the right direction, in that prior to this chart, the Coast Guard has consistently equated a day of training with a day of sea service.

It is unclear to us, because we don't have the regulatory information, how they established a 3 to 1 ratio. It is an administrative prerogative because there is no guidance provided in the convention. Until these guidelines or regulations are available, we cannot comment on their decision to use the 3 to 1, but why not a 5 to 1 ratio? Should not the course content, the instruction, the grade of the license sought, the type of vessel on which the applicant would serve, lengthen or shorten the course of instruction, rather than call for an arbitrary equation? Certainly, satisfactory completion of a prescribed examination is a measure of the training.

On some discouraging side, I did skip the part that affects this in the litany of questions that I provided. We find that the IMCO

subcommittee that established this Standards of Training and Watchkeeping convention is still at work in London, and they are now establishing principles for safe manning. They have identified the training requirements, and they are now working on the manning.

We find that the United States, and as proposed by the delegation, is advocating that each engineering watch consist of one duly qualified engineering officer. For over 25 years this industry has operated its equipment without a licensed engineer.

Until the Coast Guard interprets the convention in this respect, decisions on training must be held in abeyance.

We have several State schools and private schools that are working for training in this industry, and we are handling approximately 1,400 persons a year seeking either a license as tow boat operator, ocean operator, mate or master of mineral and oil vessels.

If IMCO's standards are enforced as they are written, all of these candidates would face signficantly longer sea service requirements unless they went to whatever this Coast Guard approved training course will be.

It is not spelled out in the comparison chart. It just says if you go to school for so many months, we will equate that, but there is no detail as to what they seek.

We have a serious problem with training schools. Our personnel work 7 on, 7 off, or 14 on and 14 off, and attendance at a school for a 1-month-long period would deprive them of wages, and we can calculate that perhaps attendance at these schools would equate to about $2,000 a month.

Now, the Coast Guard in the comparison chart has showed us that under their scheme, which is not clear to us, the training could be for 4-, 8-, or 12-month-long periods, and if it is $2,000 per month, we are looking at a significant economic impact.

I think the statement is self-explanatory in our problems establishing a dormitory school and the like, but if the ratification of the convention mandates the need for a Coast Guard approved training course, we would submit that certain of these training courses could be tailored and approved for completion at sea, not unlike the sea project referred to here and currently in use at the State and Federal maritime academies.

In this way the candidate could, while acquiring the required minimum sea service, complete an approved course that could be evaluated, if that is the Coast Guard's bent.

I think it should be noted that the convention that we speak of is purely and simply a product of big ship thinking, tailored to meet either the real or imagined problems of big ships, but I think the committee is astute enough to recognize that a simulator cure may not necessarily help small vessels.

As an aside, I must be thrilled to death I suspect, by hearing all the wonderful comments about service aboard a training aide, a small vessel. I am now faced with the uncomfortable position that our people are trained exclusively on these training aides. They acquire all their sea service on these training aides, and in fact, they are going to work aboard them.

Perhaps we can use the article on equivalents to evaluate that just by serving on a small vessel might be worth 2 to 1 just in itself, if it is such fine training.

The rest of the statement is parochial, and just in case you don't ask me, I should like to comment on how the 1-year showed up. You have heard a fair amount of opinion as to where it came from.

First of all, it came from nations, mostly northern Europe, but certainly South American nations, where public national policy is to subscribe to a strong merchant marine. They are well aware that a merchant marine, a vital one, is necessary to their economy and to their national well-being, and in so subscribing, they have structured a situation where their schools fill their needs.

They have schools all over the place. In fact, they take young men out of regular elementary training at age 12, and stuff them into a maritime school in great quantities, so much so that they have a surplus of trained engineering and deck officers.

They had no hardship in saying "why not years of sea service," because we don't have billets—they didn't explain it that way, but they have a surplus of officers, and they have no problem in acquiring extra sea service.

The language was always "adequate sea service." You will find that exists still in the engineering half of the program as a sea service requirement, and certainly the Group of 77 ran around in circles when they said 2 years. Well, it was compromised to 1 year, but I must say the United States never laid a hand on that, and this is despite the fact, that for 8 years, they have told industry, they have told our institutions, that we are out to improve the world, we have the best system in the world right now, and this will in no way change our present national practice, but when the 1 year was tabled, inside of our own delegation it was called to their attention that this departed dramatically from what they told us, but despite that, they didn't raise a hand. There was support from not only the 77 but a lot of medium-sized countries that were waiting for the United States to make some initiative.

Now I am unfair and going to take it out of context, but you have heard Admiral Benkert here this morning say, that he didn't have any particular problem dealing with 1 year's sea service. He thought it was appropriate, and I don't know if it was the motivation. But in any event, it was decided not to say one word or offer some U.S. opposition to it.

Thank you.

Mr. PANSHIN. Thank you.

Has the Offshore Marine Service Association communicated the many questions that appear in your written testimony to the Coast Guard?

Captain MAYBERRY. Yes, and they date back to 1975.

Mr. PANSHIN. What response, if any, have you received from the Coast Guard?

Captain MAYBERRY. I am afraid that we haven't had any definitive response from the Coast Guard. One of the things that also complicated the convention, if I may be permitted to just run on, the United States, as you will recall, was advocating a unilateral position as a direct result of President Carter's initiatives.

They had moved up the terms of the convention from its regular schedule, at the insistence of the United States, saying that they were unilaterally going to exercise disciplines aboard tankers, and one of the fundamental things was that the world was running junk. There were ships out there. We hit this particular December of 1976 when there were ships sinking in our territorial waters, and they were of questionable merit and flag and manned poorly, and it subscribed, and quite properly so, that there should be an international standard. But when we pushed so strongly for a treaty and a convention, when it came to problems in our own industries, and this 1 year for the State academies is pernaps a splendid example, the problems facing small vessels of under 200 tons and between 200 and 1,600 are manifold in this convention, when it was addressed to our delegation, not just at the convention but prior to it, certain people said as their advice to the head of our delegation, "Gee, it is pretty tough on one hand to be so strong and act unilaterally and demand stricter and more tight regulations for tank ships." Doesn't it look bad for the United States to come up and say, "Hey, we also have a problem for small vessels and we would like some compromise there."

I didn't feel that it was inconsistent to at least voice some concern, but it motivated the fact that they didn't do anything, and I think some of the faults of the convention, I believe they are faults, are a direct result that we took such a strong stand on international training to improve a desperate situation in some other foreign countries that we lost sight of our own initiatives and problems.

Thank you.

Mr. PANSHIN. I would agree with your observation that the provisions of the IMCO convention present a situation for the vessels in your industry which has not by any means received the same kind of public attention that regulations II/4 and III/4 have, especially III/4 as it pertains to licensing of third mates for deep-sea service.

I also understand very clearly the concerns you both have raised, not just with IMCO but also with the Maritime Education and Training Act, H. R. 5451, as it regards smaller vessels.

Your testimony was clear last year. Others have testified similarly on these issues as well. Congressman AuCoin certainly understands that you don't agree with all provisions of that bill in its present form.

At the same time, there was a companion bill proceeding through Congress, which has not yet completed its way into law; that is the small vessel manning and training bill, H.R. 5164. This bill does address those issues. As the hearings proceeded on H.R. 5451, Congressman AuCoin said both during subcommittee hearings and later as the Full Committee treated that bill that this matter of smaller vessels is a subject which this Subcommittee on Maritime Education and Training needs to address and will address, and he has committed the subcommittee to holding hearings on the subject in the next Congress. So the subject has not been completely dealt with, but it has not been forgotten either.

I assure you that your representatives from Louisiana on both the House and Senate sides will not let him forget.

Captain MAYBERRY. Thank you.

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Mr. PANSHIN. Captain Mayberry, I do have some questions for you that deal with H.R. 5451, in a Journal of Commerce article on the August 15, dealing with job placement of maritime academy cadets. You are reported as saying that H.R. 5451 will severely hamper the efforts of the M. & O. industry to hire academy graduates because the bill mandates sea service aboard vessels of more than 1,000 gross tons.

Does this article correctly report what you said?

Captain MAYBERRY. Yes. I understood the bill to read that way, but subsequent copies seem to have left out the gross tons.

Mr. PANSHIN. There was an earlier version of the bill, but in the version passed by the House, that provision is not included because of concerns that you and others in the industry did raise.

Captain MAYBERRY. Well, it certainly was inappropriate for me not to be referring to the latest bill. But the fact of the matter does stand, the Coast Guard will not allow the graduated third mate from King's Point to advance his license in an unlimited capacity, should he work with us. He could get to be master at a minimum of 300 but that does not have great appeal to those who already have an unlimited third-mate's license.

Mr. PANSHIN. I did want to clarify that point.

Captain MAYBERRY. That article went on to quote somebody else that they instructed Senator Long.

Mr. PANSHIN. That was in an adjacent article. But I did want to point out that your concerns were noted and reflected in H.R. 5451.

Captain MAYBERRY. It was immediately brought to my attention.

Mr. PANSHIN. Given this service requirement for the graduates of Federal and State academies, service in your industry could satisfy a portion of that requirement.

Captain MAYBERRY. The reason we made the comments when it did appear in the form of the bill, we felt that would not permit any institutions to be considered by Congress or the Maritime Administration within our area, and——

Mr. PANSHIN. That concern is noted as well and will be part of the subject of next year's hearings.

Captain Muth, I started on this questioning earlier during your summary, and the Coast Guard has indicated they intend to accept time on small vessels as partial fulfillment of the sea license requirement. How much of the 12 months would you recommend that smaller vessels be allowed to provide?

Captain MUTH. I think we would like to see either 25 or 33 percent, either 3 or 4 months.

Mr. PANSHIN. Thank you.

How available are vessels in your association for this kind of training? You did indicate in your formal testimony that you have a program with the Coast Guard, but I was wondering to what extent your membership would be interested and willing to be involved.

Captain MUTH. We have interest by east coast and west coast towing companies. One of the companies has taken Maine Maritime Academy people on board in the past. The inland situation has not been canvassed. It is a matter that we have to see if it can be done. The accommodations are available on inland vessels. With

the coastal vessels. I think there is a problem as to space on some smaller towboats.

Mr. PANSHIN. Would you have a rough estimate as to how many cadets your association might be able to accommodate?

Captain MUTH. I would limit it to 25 or 30 for the first year. I think once the program gets underway, we will see a growth and better acceptance on the part of the industry.

Mr. PANSHIN. Partly it is a matter of industry getting used to the program.

Captain MUTH. Yes. We have encountered similar problems in training of Coast Guard cadets and junior officers, but it is well accepted now.

Mr. PANSHIN. What advantages do your member firms see in taking Coast Guard officers and cadets to sea with them?

Captain MUTH. They feel it provides an educational process for those individuals who later come back to haunt them.

Mr. PANSHIN. Have their fears and hopes been sustained?

Captain MUTH. Everybody, industry and the Coast Guard, feels it is a valuable program.

I would like to make two comments on the impact of the IMCO convention to the towing industry. We do not know how severely we will be impacted because there are two categories involved. One category is ships engaged in near-coastal voyages and the other is ships engaged outside near-coastal voyages. Those ships not engaged in near-coastal voyages, which means outside some now undefined boundary, of less than 200 gross registered tons will be required to have a licensed master and licensed man in charge of the navigational watch who holds a license equivalent to the 200-to-1,600-gross-ton license, dependant upon what is defined as a near-coastal voyage. That would mean some of the people holding a towing operator's licenses would not hold a valid license if they went beyond what is now an imaginary boundary. In talking informally with the Coast Guard, I am told they envision that the line might go out to 200 miles offshore. That it would also include some of the coastwise voyages, for example, to Alaska, the West Indies, and probably also intercoastal voyages. This leaves the voyage between the west coast and Hawaii dangling. As it looks now, it seems the towing operator license would not be a valid license for that trip.

The only other immediate impact that we can see is one that would affect our second-class towing operator's license. Currently he is required to serve only 18 months at sea before being eligible to sit for the license. Under the IMCO rules, he would have to undergo special training plus an adequate period of sea time, or complete 3 years at sea. So, some of these people who come up for a license without the 3 years sea duty, I assume, would have to prove they have had some special type training. I do not know how severely this would impact us, but it would have an effect. Outside that, I do not know of anything else that will cause the towing industry any great pains.

Mr. PANSHIN. Fine.

Mr. Losch.

Mr. LOSCH. No questions.

Mr. PANSHIN. May I at this time call panel number 5, the simulator panel.

Welcome to the subcommittee hearing. The topic we are addressing today would be deficient without hearing from the simulator manufacturers and operators. I do not know if it is best to be first or last. Nonetheless the subcommittee is looking forward to receiving your testimony. It will contribute to the recommendations the subcommittee will make on sea training of cadets.

Mr. Miller, may we have your statement first.

STATEMENTS OF EUGENE R. MILLER, JR., VICE PRESIDENT, HYDRONAUTICS, INC.; DOUGLAS A. HARD, DIRECTOR, MARINE SAFETY INTERNATIONAL, ACCOMPANIED BY ELMER G. GLESKE, VICE PRESIDENT FOR GOVERNMENTAL AFFAIRS, FLIGHT SAFETY INTERNATIONAL; AND ALAN PESCH, PRESIDENT, SHIP ANALYTICS

Mr. MILLER. My comments are related to the feasibility of low-cost ship-handling simulators and their potential application in the training of deck officers. I am a vice president of Hydronautics, Inc., of Laurel, Md. Hydronautics, Inc., which has been in existence about 21 years, is a research and engineering organization whose primary activities are in the support of the ship design, ship construction, and ship operations communities. We have designed, built, own, and operate extensive facilities including a ship bridge simulator, large ship model testing basin, a water channel, and a computer center. I am a naval architect and am the head of the department which operates these facilities.

It is possible to build a relatively low-cost real-time ship-handling simulator. At Hydronautics we have had a program to develop such a simulator for several years, and a system is now operational at our facilities. We have also provided a version to the U.S. Coast Guard. Our initial purpose was to develop a simulator for use in our research and engineering projects, which include ship design evaluations, port studies, and accident investigations. Our experiences and discussions with experienced operators indicate to us that this same basic type of simulator may have potential for operator training.

I would first like to discuss what I mean by a low-cost ship-handling simulator, and then to discuss potential applications and make some suggestions for possible actions. Low-cost in this context means in the range from $200,000 to $400,000.

The features which would be included in a low-cost ship-handling simulator are as follows:

First, mathematical model which represents the ship dynamics in response to control inputs and the simulated environmental forces. The equations and associated coefficients should be able to represent the ship in all modes of operation, including slow speed and astern motion. The environmental forces should include wind, current, waves, shallow water, bank suction, et cetera. Different ship types and sizes are modeled by use of the proper coefficients and constants in the equations.

Second, computer program which implements the mathematical model, monitors simulator control, and drives the displays.

Third, full-scale bridge or pilot house mockup with the appropriate equipment and displays including: steering stand; control console with throttle controls, thruster controls, and displays of RPM, speed, rudder angle, wind speed and direction, et cetera; radar display; and chart table.

Fourth, simulator control console to run the simulator, change conditions, set up new problems, et cetera.

Fifth, minicomputer to run the simulator.

Sixth, out-of-the-window visual scene displayed on one or more TV screens. The scene is a simplified computer-generated image which may be generated by the simulator minicomputer or a dedicated microcomputer. The photographs included with these comments illustrate some of these features.

The characteristics which distinguish this type of system from the more typical ship bridge simulator mentioned earlier are basically in the size of the computer used and in the complexity of the displays. No compromises need be made in the mathematical modeling of the ship and the environment. Very complex ship-handling situations can be represented.

In summary, low-cost ship-handling simulators can be built that accurately reproduce the ship dynamics, and that rely on somewhat simplified displays, particularly for the out-of-the-window visual scene.

Ship-handling simulators are now being used in the training of deck officers. In general, the personnel involved are relatively senior, and the training applies to specific ship types or specific locations. When considering the training of students of maritime academies, several basic questions will have to be answered. They are: What knowledge is to be provided? To what extent can simulations be used in the teaching of this knowledge? What are the required characteristics of the simulators? I am personally not in a position to answer these questions, and can only urge that the studies directed at obtaining answers be continued. It is certain that the conclusions from such studies, particularly those related to simulator characteristics, will have a major impact on simulator cost and, as a result, no option should be overlooked.

From our experience, it is reasonable to assume that a relatively low-cost ship-handling simulator, such as the one described above, would be useful as a part-task trainer in the teaching of the principles of ship handling, radar navigation, and collision avoidance and bridge teamwork. Principles of ship handling include the effects of vessel size and type on reaction time, turning, stopping and backing, use of rudder and throttle for maximum effectiveness, and the effects of environmental factors such as winds, currents, shallow water, banks, and passing ships. It is unlikely that a low-cost simulator would be useful for teaching tasks which depend directly on quantitative observations of the visual scene. Such tasks might include collision avoidance by visual observation, position fixing by visual observations, et cetera.

It should also be noted that low-cost ship-handling simulators have been used successfully for nontraditional vessel types and situations such as very long river push tows, a tug towing a large barge or a disabled ship, or a vessel coming alongside a drifting vessel. To date, traditional simulator training has involved large

vessels or those with hazardous cargoes. On such vessels a recently graduated officer will have little or no responsibility for ship handling. However, a number of graduates do go to smaller vessels, large tugs, or the offshore industry. For these graduates, simulator training in these nontraditional areas may be of great value.

In summary, a relatively low-cost ship handling simulator may have application as a part-task trainer in the teaching of ship handling, radar navigation, and collision avoidance and bridge teamwork. The concept is attractive because it can provide more simulator time at a given cost, operational flexibility, and quick turnaround times for a wide range of situations and vessel types.

Based on the above comments, I would recommend that low-cost simulator concepts, such as the one described, be evaluated in the ongoing research programs directed at the determination of required simulator characteristics. Perhaps a sample group of students could be trained on such a simulator, and their performance compared with another group trained on a more complex simulator. Consideration should also be given to the problems the maritime academies will have in integrating simulators into their curriculums. Since the delivery time is reasonable and the cost is modest, it may be worthwhile to provide a simulator to one of the academies. This would provide a base of actual experience for use in the evaluation of plans for extensive use of simulators at all of the academies.

Mr. PANSHIN. Thank you, Mr. Miller.

[The statement of Eugene R. Miller follows:]

PREPARED STATEMENT BY EUGENE R. MILLER, JR., VICE PRESIDENT, HYDRONAUTICS, INC.

Mr. Chairman and Distinguished Members of the Select Subcommittee on Maritime Education and Training, my comments are related to the feasibility of low-cost ship handling simulators and their potential application in the training of deck officers. I am a Vice President of Hydronautics, Incorporated of Laurel, Maryland. Hydronautics, Incorporated, which has been in existence about 21 years, is a research and engineering organization whose primary activities are in the support of the ship design, ship construction and ship operations communities. We have designed, built, own and operate extensive facilities including a ship bridge simulator, a large ship model testing basin, a water channel and a computer center. I am a Naval Architect and am the head of the department which operates these facilities.

It is possible to build a relatively low-cost real-time ship handling simulator. At Hydronautics we have had a program to develop such a simulator for several years and a system is now operational at our facilities. We have also provided a version to the U.S. Coast Guard. Our initial purpose was to develop a simulator for use in our research and engineering projects which include ship design evaluations, port studies and accident investigations. The system we have provided to the Coast Guard is also intended for these types of research and engineering studies. Our experiences and discussions with experienced operators indicates to us that this same basic type of simulator may have potential for operator training.

I would first like to discuss what I mean by a low cost ship handling simulator and then to discuss potential applications and make some suggestions for possible actions. Low cost in this context means in the range from 200 to 400 thousand dollars.

The features which would be included in a low cost ship handling simulator are as follows:

A mathematical model which represents the ship dynamics in response to control inputs and the simulated environmental forces. The equations and associated coefficients should be able to represent the ship in all modes of operation including slow speed and astern motion. The environmental forces should include wind, current, waves, shallow water, bank suction, etc. Different ship types and sizes are modeled by use of the proper coefficients and constants in the equations.

A computer program which implements the mathematical model, monitors simulator control and drives the displays.

A full-scale bridge or pilot house mockup with the appropriate equipment and displays including:

Steering Stand.

Control Console with throttle controls, thruster controls and displays of RPM, speed, rudder angle, wind speed and direction, etc.

Radar Display.

Chart Table.

A simulator control console to run the simulator, change conditions, setup new problems, etc.

A mini-computer to run the simulator.

An out-of-the-window visual scene displayed on one or more T.V. screens. The scene is a simplified computer-generated image which may be generated by the simulator mini-computer or a dedicated micro-computer.

The photographs included with these comments illustrate some of these features.

The characteristics which distinguish this type of system from the more typical ship bridge simulator are basically in the size of the computer used and in the complexity of the displays. No compromises need be made in the mathematical modeling of the ship and the environment. Very complex ship handling situations can be represented.

With respect to distinguishing characteristics, the latest generation of commercial mini-computer, programmed in a high level language, is used instead of a special-purpose simulation computer. The bridge equipment is specially built rather than adapted from actual marine hardware. The bridge displays can duplicate a typical ship arrangement with separate analog meters for each function, or a single computer-generated display for a number of functions can be provided. The radar display is based on computer graphics presented on a CRT screen rather than a computer-generated signal for an actual radar. The visual scene is a computer-generated perspective line view in black and white on T.V. screens rather than a scene projected on a circular screen outside the windows. The scene content is low compared to that generated from a model-board system or a more complex computer-image generator. It may be noted that computer graphics hardware is rapidly decreasing in cost, so that soon, features such as color and increased scene content and resolution can be added with small cost impact.

In summary, low-cost ship-handling simulators can be built that accurately reproduce the ship dynamics, and that rely on somewhat simplified displays, particularly for the out-of-the-window visual scene.

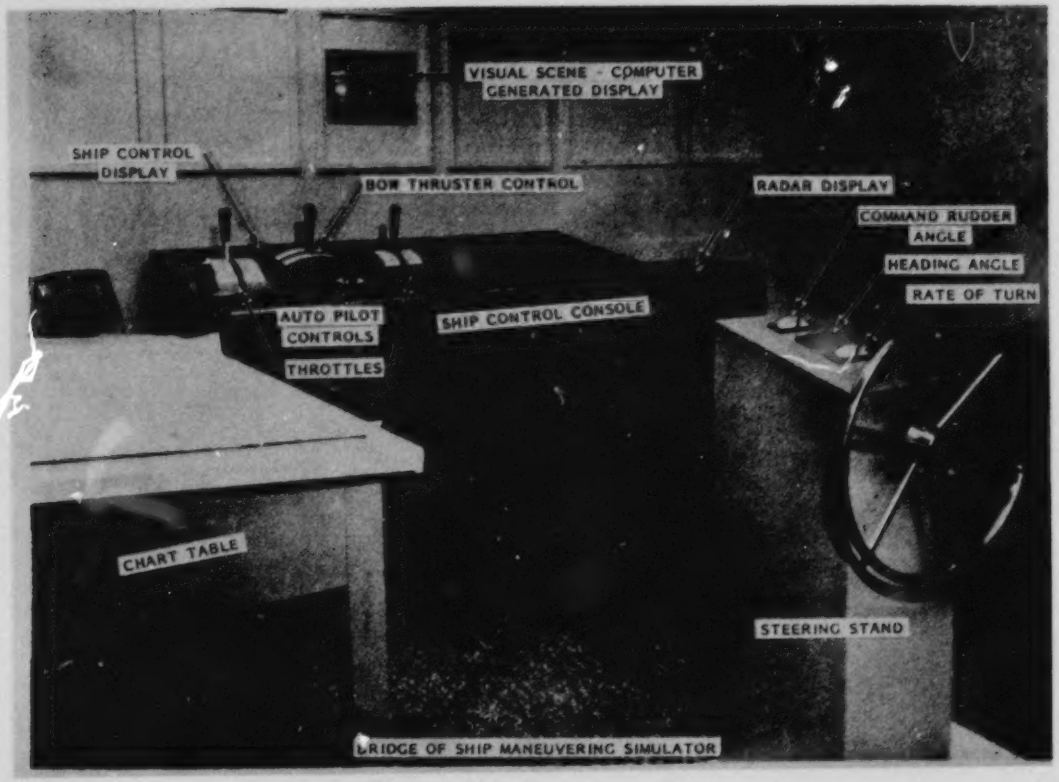
Ship-handling simulators are now being used in the training of deck officers. In general, the personnel involved are relatively senior, and the training applies to specific ship types or specific locations. When considering the training of students of maritime academies, several basic questions will have to be answered. They are: what knowledge is to be provided? To what extent can simulations be used in the teaching of this knowledge? And what are the required characteristics of the simulators? I am personally not in a position to answer these questions, and can only urge that the studies directed at obtaining answers be continued. It is certain that the conclusions from such studies, particularly those related to simulator characteristics, will have a major impact on simulator cost and, as a result, no option should be overlooked.

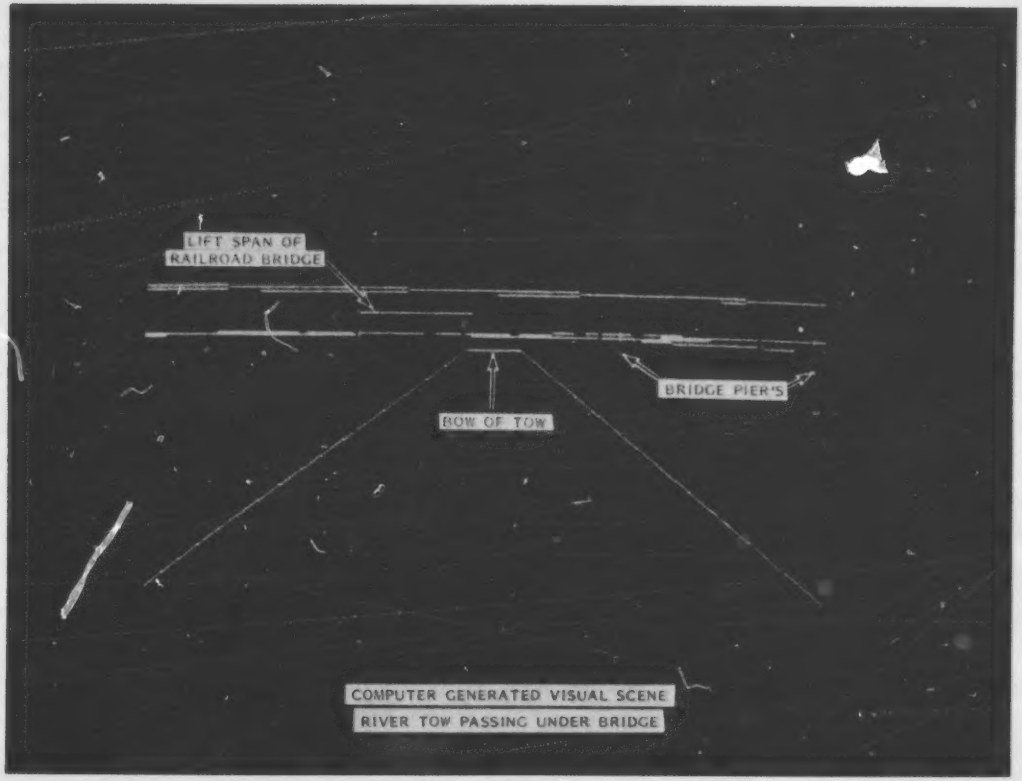
From our experience, it is reasonable to assume that a relatively low cost ship handling simulator, such as the one described above, would be useful as a part-task trainer in the teaching of the principles of ship handling, radar navigation and collision avoidance and bridge team work. Principles of ship handling include the effects of vessel size and type on reaction time, turning, stopping and backing, use of rudder and throttle for maximum effectiveness, and the effects of environmental factors such as winds, currents, shallow water, banks and passing ships. It is unlikely that a low-cost simulator would be useful for teaching tasks which depend directly on quantitative observations of the visual scene. Such tasks might include collision avoidance by visual observation, position fixing by visual observations, etc.

It should also be noted that low cost ship-handling simulators have been used successfully for non-traditional vessel types and situations such as very long river push tows, a tug towing a large barge or a disabled ship or a vessel coming alongside a drifting vessel. To date traditional simulator training has involved large vessels or those with hazardous cargos. On such vessels a recently graduated officer will have little or no responsibility for ship handling. However, a number of graduates do go to smaller vessels, large tugs or the offshore industry. For these graduates, simulator training in these non-traditional areas may be of great value.

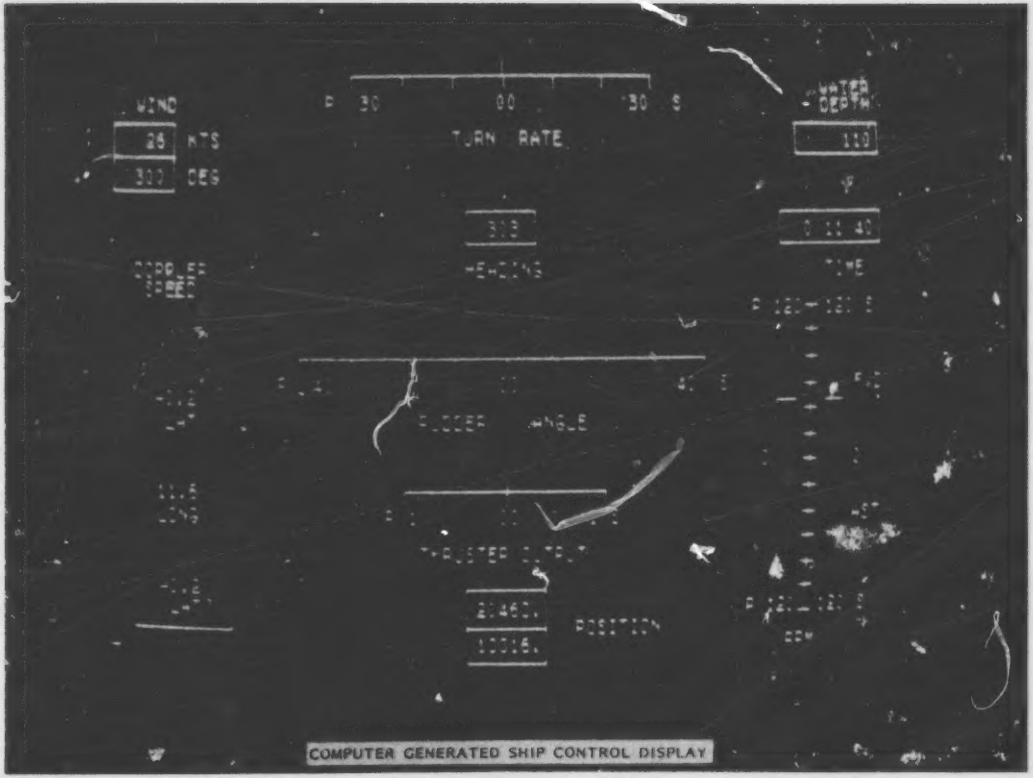
In summary, a relatively low-cost ship-handling simulator may have application as a part-task trainer in the teaching of ship handling, radar navigation and collision avoidance and bridge teamwork. The concept is attractive because it can provide more simulator time at a given cost, operational flexibility and quick turn-around times for a wide range of situations and vessel types.

Based on the above comments, I would recommend that low-cost simulator concepts, such as the one described, be evaluated in the ongoing research programs directed at the determination of required simulator characteristics. Perhaps a sample group of students could be trained on such a simulator, and their performance compared with another group trained on a more complex simulator. Consideration should also be given to the problems the maritime academies will have in integrating simulators into their curriculums. Since the delivery time is reasonable and the cost is modest, it may be worthwhile to provide a simulator to one of the academies. This would provide a base of actual experience for use in the evaluation of plans for extensive use of simulators at all of the academies.


VISUAL SCENE - COMPUTER GENERATED DISPLAY
SHIP CONTROL DISPLAY
BOW THRUSTER CONTROL
RADAR DISPLAY
COMMAND RUDDER ANGLE
HEADING ANGLE
RATE OF TURN
AUTO PILOT CONTROLS
SHIP CONTROL CONSOLE
THROTTLES
CHART TABLE
STEERING STAND
BRIDGE OF SHIP MANEUVERING SIMULATOR



COMPUTER GENERATED VISUAL SCENE
RIVER TOW PASSING UNDER BRIDGE



COMPUTER GENERATED SHIP CONTROL DISPLAY

119

Mr. PANSHIN. We will receive the summaries of all three panelists before proceeding with questions. Next we shall hear from MarineSafety International. Mr. Gleske.

STATEMENT OF MR. GLESKE, FLIGHT SAFETY INTERNATIONAL

Mr. GLESKE. The comments I am going to make are based on our company's 30 years of experience providing training to professional pilots and 4 years of experience in providing training to mariners.

I have five points I would like to focus on which summarize our views. We believe that a well-designed simulator course can supplement sea training and meet the IMCO training requirements. A well-designed simulator course seems to be the crux of the matter, as one of the previous witnesses commented.

We believe in presenting a course, the simulator is really secondary. The course must be designed to meet certain defined objectives. The staff which presents the course is just as important as the equipment used in the program. In considering the IMCO requirements, midshipmen are working toward gaining their third officers' licenses, and as third officers their primary functions include watchkeeping, navigation, and collision avoidance. Therefore, we think the course should be designed around these functions.

There have been comments made about the Federal government subsidizing simulator training at the academies and that simulator training at the academies be offered to the commercial sector. We feel very strongly that this would be a definite conflict of interest for the government to do the licensing and the training. By that I mean the spillover of simulator training from the academies to the commercial operators. We feel it can best be done by the private sector.

Two final points. Simulation is not the total answer. As in the aviation industry, there is no substitute for real time hands-on experience.

Previously we have made this offer informally, MarineSafety is prepared to work with the Maritime Administration, the Coast Guard, and the academies to provide whatever courses and equipment are necessary at each of the academies to meet the requirements.

[The statements of Elmer G. Gleske and Douglas A. Hard follow:]

PREPARED STATEMENT OF ELMER G. GLESKE, FLIGHTSAFETY INTERNATIONAL AND DOUGLAS A. HARD, MARINESAFETY INTERNATIONAL

Mr. Chairman and members of the committee, thank you for the opportunity to participate in this hearing on how IMCO's 1978 International Convention on Standards of Training, Certification and Watchkeeping for Seafarers will affect the education and training at our maritime academies. My name is Elmer G. Gleske, I am the vice president for Governmental Affairs of FlightSafety International (FSI). With me is Captain Douglas A. Hard, director of MarineSafety International (MSI) which is our wholly owned maritime training subsidiary.

In 1974, after a thorough investigation of need and market potential, FSI management concluded that sophisticated ship simulators could meet some of the training requirements for masters, pilots and navigating officers responsible for handling large and complex ships. With the encouragement of the Maritime Administration, FSI spent several million dollars of its own resources to purchase a ship simulator and establish a maritime training facility. Our original plan was to place the facility in the United Kingdom where our market studies indicated the greatest utilization potential, but in compliance with a direct request from MARAD, we had the simulator installed in New York to keep this new and advanced technology here in

the United States. As a result, MSI was incorporated, and in 1976 began to offer training services to the maritime industry worldwide.

Since then the highly professional staff of experienced mariners and educators, headed by Captain Hard, has trained more than 820 licensed and unlicensed maritime personnel. In addition to the original visual ship simulator, MSI has the world's only Liquefied Natural Gas (LNG) cargo handling simulator, and several electronic navigational aid simulators. Two restricted visibility bridge simulators are now being constructed, and an engine room simulator is in its final stages. Soon MSI will be able to train virtually an entire ship's complement. In each case the simulators have added substantially to the quality and scope of coverage possible in each training program.

With respect to sea training requirements, the proposed IMCO regulations require not less than 365 days seagoing experience for all candidates seeking certification as officers in charge of a navigational watch on ships of 200 gross registered tons or more. We understand the maritime schools in the United States will be hard pressed to meet this requirement within the boundaries of their present programs; however, the spirit of these proposed regulations should be complied with in some manner.

A possible solution to this dilemma lies within Article IX of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers. That article explains that the government of any country may establish equivalents for seagoing service. This allowance is made with the provision, however, "that the level of seagoing service, knowledge and efficiency as regards navigational and technical handling of ship and cargo ensures a degree of safety at sea . . . at least equivalent to the requirements of the Convention."

If and when the Convention goes into effect, MSI believes each of the maritime academies can meet the minimum one year seagoing requirement by supplementing their present programs with ship simulator training.

We also affirm that the quality of such simulator training depends primarily upon the qualifications of the instructional staff and how thoroughly they have prepared the exercise programs. The ship simulator, although essential, is secondary. Proper training methods and a well prepared exercise plan are more significant in establishing an equivalency than any particular kind of hardware. Instructional development has proven that undergraduate training does not require the same degree of expensive sophisticated simulation necessary for teaching experienced professionals.

Based on MSI's past four years of experience in simulator training, it must be stated that the maritime academies' budgets will be hard pressed just to maintain and operate ship simulators, let alone purchase them. Even if the government provides each academy with a simulator the obvious way to relieve the budgetary strain imposed by ownership of a simulator would be to use it to enter the commercial training market. That, however, would place the government in the position of subsidizing direct competition with the private sector. We think it would be unconscionable for such government subsidized competition to occur. Particularly when four years ago we were asked by the government to establish a simulator training facility in this country.

Further, we believe that the public interest is best served when the government establishes and maintains high training standards and requires the impartial evaluation of personnel in the industry. The conflict of interest created by the government doing both the regulating and training of people in the commercial sector is avoided if the private sector provides training to commercial operators.

MSI is prepared to cooperate fully with MARAD and each of the academies in assisting them to comply with IMCO's training requirements. We would be pleased to provide, operate and maintain whatever simulator courses and equipment are necessary at the Academies to satisfy IMCO requirements.

MSI's maritime simulator training experience is extensive and has the additional benefit of FSI's nearly 30 years of training experience. Since 1951 FSI has provided training services to professional pilots. Today, FSI operates 38 flight simulators at 20 different learning centers in the United States and Europe. It provides training courses to more than 7,000 pilots annually from more than 1,400 corporations, all the military services, FAA, NASA, the airline industry, foreign governments and foreign corporations.

There is no doubt that simulators cannot, and should not be thought of as a one hundred percent replacement for actual hands-on experience, whether it be aboard an airplane or a ship. Nothing will ever replace the benefit of real experience, but certain areas of training can be done far better and safer in a simulator. Simulation has an important and rightful place in the aviation and maritime communities' training programs and, we believe, that properly developed and administered train-

ing programs can provide the supplemental training necessary for each academy to meet the convention's acceptable equivalence of seagoing experience.

Thank you for the opportunity to present our views. We will be pleased to answer any questions you may have.

Mr. PANSHIN. Thank you for your comments.

Mr. Pesch.

STATEMENT OF MR. PESCH

Mr. PESCH. My name is Alan Pesch, president of Ship Analytics. Our firm represents a total resource in the area of ship simulation. What I mean by that and the reason I preface my remarks is that we define the requirements for training and are our experts in that area. We conduct and operate several simulator facilities in the United States and we also design and manufacture the hardware for the systems.

The major theme that extends throughout my remarks today is that a match exists at this point in time between the maturity in the simulation industry and the emerging characteristics and requirements stemming from the national and international marine community which is calling for this technology.

Over the last 10 to 15 years, largely in Northern Europe, beginning with applications in Grenoble and the efforts in the U.S. CAORF we have gone through a complete development cycle. We are now building and delivering third-generation technology, the cost of which is far below that which now exists in present simulators. The costs have come down, to a plateau and they will not be getting that much better.

Finally, as to benefits achieved from simulation. I think a review of the research conducted by CAORF and the Coast Guard brings home the issue of the value of simulators. This committee has addressed that question several times today seeking answers. The answers do exist in experimental results. The Valdez experiments conclusively show that operational experience gained on a simulator is comparable to that based exclusively on ships entering the port.

The study conducted by the Coast Guard and the Maritime Administration now in its third phase has a great deal of data which can be used to define simulator characteristics and can be applied today. There is data out there for management to proceed with.

I will wind up my remarks with a very brief statement, that all through the hearing today, we have sought a blend of training technologies, between small ship handling, simulator training, and application of time at sea. We concur that a blend has to exist, but we urge the committee to understand that blend should not be confused between obtaining skills for at-sea and time-at-sea, relating to acclimation to the job, as opposed to licensing and certification needs. These are two different things. In short, a simulator shortens the time to achieve the skills. That mixture should not be confused with the attainment of acclimating to a job at sea as opposed to skills attained on a simulator.

With that, I will conclude.

[The statement of Alan J. Pesch follows:]

PREPARED STATEMENT OF ALAN J. PESCH, PRESIDENT OF SHIP ANALYTICS, INC.

Thank you, Mr. Chairman.

I appreciate the opportunity to testify before this committee regarding the use of simulators for marine training. Our credentials for doing so derive from the fact that our company has been active in the field of marine simulation for over 10 years. By way of introduction to our firm I might briefly outline our background.

Our firm represents a total resource in the area of marine simulation. This means that we have been active in all of its major disciplines and development aspects. These include the development of training requirements for definition of training simulators and the development and operation of major research and training simulators. Additionally, we design and manufacture advanced bridge simulators and training devices which include full color computer generated imagery (CGI) visual systems, as well as training systems for cargo handling and engineering operations.

The major theme of my remarks is that we find ourselves today at a point in time where a match exists between the maturity achieved in simulator technology, application and costs, and the international and national regulatory requirements calling for application of the technology.

The current levels of maturity in simulator technology had its beginnings in the late 60s through the early 70s in Europe. This was followed by developments in this country by Marine Safety Inc. and the application of CAORF by the U.S. Maritime Administration in the mid-70s. Throughout this time period refinements in simulation and, importantly, world-wide acceptance by seafarers increased dramatically. Within the last several years, the U.S. Coast Guard and the Maritime Administration jointly sponsored a research program in the area of applying simulators to certification and training of U.S. merchant marine personnel. The findings supported the application of training simulators for cadets, chief mates and masters skill levels, as well as defining the major design characteristics required in a marine simulator context. Finally, a technological maturity has occurred within the past 2 years to a point where low cost, high fidelity CGI systems are now affordable by a wide segment of the marine community.

Regarding the development of international and national requirements, a quick overview would reveal that prudent ship operators on both a national and international basis paved the way for the development of these training simulators as early as the late 60s. Their support began with the development of the Grenoble facility by EXXON and has proceeded by numerous ship operators sending crews for typically a one week training period to various simulators world wide. This impetus was followed by national legislation in the form of the Port and Tanker Safety Act of 1978 which contains repeated references to the application of simulation technology to the training and certification of merchant marine personnel. Finally, the IMCO Convention, which is the subject of this meeting, has defined a requirement for seagoing time which represents a somewhat unique anomaly for our state and federal maritime training institutions in meeting international standards as compared to the training available in other nations.

Given that a certain degree of concomitant development has occurred between simulator technology and the national and international requirements for its application, I would suggest that this committee seriously consider the benefits to be derived from the inclusion of simulation technology in the total curriculum context offered by our federal and state training institutions. It is important to note that a proper balance of seatime, classroom, and simulator application should be achieved.

The benefits of simulation have been clearly identified and validated in the marine context through numerous experiments on the U.S. Maritime Administration's CAORF simulator. These studies have included comparison of the responses typically performed by a deck officer at sea to those performed in the simulator, and have shown that these responses are essentially equivalent. Further studies have demonstrated the advantages of simulator exercises for a specific port, notably Valdez, Alaska. This experiment showed that personnel whose experience was based exclusively on ships entering the port performed equivalently with personnel whose experience at Valdez was exclusively on the CAORF simulator and further, that personnel who received no experience at CAORF nor on ships transiting into Valdez resulted in off-track deviations three times as great as those who had experience on the simulator or who had at-sea experience in Valdez.

Studies conducted by the U.S. Coast Guard and U.S. Maritime Administration have demonstrated that the major characteristics of marine training simulators may be defined as a function of stated training requirements. Results have shown the need for full color daylight and night scenes, maneuvering targets, relatively large fields of view, and, importantly, the requirement to design a sufficient training subsystem into the simulator to assure that its training effectiveness is actually achieved. The important point is that sufficient data are currently in hand to broadly define and specify a training simulator for cadet training applications as

well as those at a master or chief mate level and we currently manufacture and operate such a system.

Importantly, the technology is available to achieve these simulator characteristics at relatively low cost, ranging from 1.5 million dollars to 4.5 million dollars depending on the characteristics selected. The facilities may be maintained and operated by a relatively small staff of personnel as a function of the high inherent reliability of third generation technology.

With respect to the future applications of marine simulation, I would forecast a widespread proliferation of these devices in both the commercial and government sectors of the marine industry. This proliferation will continue as a function of an increasing demand for training both from the regulatory process and from prudent commercial shipping interests. Future development trends will shift from the emplacement of simulators to the emplacement of training systems whereby the curriculum and advanced instructional technology is combined with the delivery of the simulator. Logical expansion will develop in the offshore and fishing industries. Finally, as a function of widespread use and application of these devices, quantitative data bases will become available which define the current skill levels of our merchant marine personnel as they utilize simulators and allow regulatory authorities to establish reasonable quantitative standards for deck officer performance. These may, in this form, be acceptable to the industry and can be traced to the enforcement of legislation such as the Port and Tanker Safety Act of 1978. Through the application of this technology within the United States, and the pioneering efforts of facilities such as CAORF, a widespread acceptance of simulation by merchant marine personnel will continue to a point where the United States is in a position of world leadership and demonstrated excellence in the skills and operational safety of its merchant marine industry.

Thank you for the opportunity to present this information. I will be pleased to answer any questions the subcommittee may have.

Mr. PANSHIN. You said in your written statement that the IMCO convention has defined an anomaly for the schools?

Mr. PESCH. By and large, our training institutions exceed or surpass in all respects the qualifications under the IMCO convention. This is the one area where our country is deficient. Other countries bring their seafarers up through the ranks and their qualifications are better than ours in respect to seatime. Therefore the word "anomaly."

Mr. PANSHIN. What is your response to the statement as to whether we need a simple or complex simulator?

Mr. PESCH. Any simulator is not defined by how good or complex it is. It is rather defined by the training objectives that are sought to be achieved. You need to define the requirements at the level that will be applied in cadet requirements in this case. Certainly, very simple simulators as mentioned by Admiral Bell this morning would suffice at certain levels but probably a more complex device is required to actually "train" cadets.

Mr. PANSHIN. If you can, define skill requirements.

Mr. PESCH. Skill requirements for a cadet are different than those for a master or chief mate as you define the characteristics that defines the system. Complexity does not enter into the question. Use is defined where it fits into the curriculum of the individual. Certainly a very simple simulator could be applied at Piney Point. You are talking about achieving the trained "exit" characteristics of that school which is the final upgrading of unlicensed seamen who only need to learn to handle the wheel well. We are talking here today about cadets whose "entry" characteristic begins where Piney Point leaves off. This requires a more complex simulator.

Mr. PANSHIN. Do any of the other members of this panel wish to respond to that statement?

Mr. GLESKE. I cannot find fault with that. It is in line with our thinking. I will defer to Captain Hard. He is the educator in the company.

Captain HARD. My name is Douglas Hard. I have been very surprised listening to the comments today. First, we seem to be questioning our training programs. Our training programs are probably among the best if not the best in the world. We have gotten ourselves caught in a situation with this 365-day requirement. I think far too much stress is being given to this.

A third officer is going to stand watch. He is going to be expected to handle routine watchkeeping. He will be expected to do routine voyage planning. He will be expected to handle emergencies which occur during his watch and know what procedures to follow to get a qualified senior man onto the bridge. The important thing is to identify how we can better do this and better achieve these training objectives. I would like to give an example of how seatime is not a valid measure. Whether a cadet is on a training ship, a commercial vessel, or whatever other craft he may be training aboard, if he is making a trans-Pacific crossing, he can spend 12 months crossing the Pacific and never encounter a traffic condition. The same cadet can spend a week going up and down the east coast and probably have as much experience as an apprentice on that vessel, as many officers making a trans-Pacific run.

We have to focus in on the exposure we want these people to have and how we go about achieving that. Obviously, routine situations and emergencies, these are definite areas for which there are procedures prescribed. But the beauty of using a simulator is that for the situation where a man must rely on his own judgment, perhaps not based on his experience or anybody else's experience, he must choose from the alternatives available to him. Perhaps the best alternative is to call for help. Perhaps the best alternative is to rely on your training. You can do this with a simulator and it does not have anything to do with time.

The Coast Guard has already accepted simulator training in lieu of time-at-sea training. I am puzzled that this is not an approved procedure. We have done it in the liquified national gas cargo handling training; it has been accepted by the Coast Guard since 1977; we have done simulator training in geographic familiarization, for example the Savannah River and Fort Valdez, Alaska. I think it has proven itself. By the fact that such training has been accepted by the Coast Guard and we are going into the fourth year of this type training. There is no question that it has been valid. When it applies to undergraduate training, there seems to be a question. I submit our experience proves it is valid to use simulators.

Mr. PANSHIN. Mr. Miller, do you have any opinion?

Mr. MILLER. I think the question was can simulators be fairly simple?

I think my opinion would be somewhat of an intuitive one, but I would think that very useful simulations can be done with the equipment and systems which are a lot simpler than one might suppose at the outset, and that I think is a valid subject for investigation, for the committee's investigation.

Mr. PANSHIN. Thank you.

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The simulator you described, to what extent would you feel that this type of simulator would have value to the officer who is going through upgrading, in contrast to the cadet who is in training for his or her initial license?

Mr. MILLER. You are referring to a relatively simple simulator?

Mr. PANSHIN. Yes.

Mr. MILLER. I would think that it may very well have as much or perhaps more value to an office undergoing upgrading than to a cadet. If we are talking about the questions related to ship handling specifically, presumably more senior officers have more responsibility in that area.

Mr. PANSHIN. Mr. Gleske testified in opposition to simulators at the State academies entering into competition in the commercial marketplace with simulators used for continuing education programs.

Do either of the other simulator manufacturers here have an opinion on that?

Mr. GLESKE. That is for a full mission simulator.

Mr. PANSHIN. Yes, for full mission.

Mr. MILLER. Since our organization is primarily involved in engineering as opposed to training, I don't really have an opinion on that one way or another.

Mr. PANSHIN. Mr. Pesch?

Mr. PESCH. We have no objection to it since we believe it to be a logical outgrowth. I don't think you can stop something like that. I think it's going to occur. I think it's for the benefit of the industry and I think it's for the benefit of the institution and right across the board.

I endorse it, as a matter of fact.

Mr. PANSHIN. How many full mission simulators does this country need?

Mr. PESCH. In my opinion?

Mr. PANSHIN. In your opinion.

Mr. PESCH. Our market survey shows somewhere in the area of 5 to 10 systems.

Mr. PANSHIN. Mr. Gleske or Captain Hard, would you care to comment on the utilization of your present simulator and whether you would agree with that comment?

Captain HARD. I don't think there is agreement as to the definition of a full mission simulator. I have heard a great deal said today about the operating simulators worldwide, and until the definition of a full-mission simulator is agreed upon, I think we are in a very gray area.

Example: Our simulator, it's a relatively simple one as far as the mechanics, but it can simulate virtually anything that a vessel can do night or day. That includes underway replenishment, docking, berthing, and locking. The only thing it can't do is run where there is insufficient water, which is exactly what you want a simulator to do.

There are other simulators that are prettier, that are more expensive, that have fancier images, but that does not a full mission simulator make, and I would question, going back to what I said before, the whole basis, the whole value of simulation is to use it for your training objective.

You don't want a big fancy simulator to train a man how to use a radar. He goes in there knowing how to use the radar. You are training him to handle his vessel and to stand his watch.

You are training him to be a better officer, to plan that voyage, to work well as a team with the other people on the bridge. You don't use the full-mission simulator to teach him how to use a Loran set or use a collision avoidance system. That is a separate task, perhaps on a part-task simulator, perhaps in a classroom.

How many of these full-mission simulators are needed; that depends on the degree of training you wish to accomplish, but at this point there isn't any agreement as to the definition of a full-mission simulator.

Mr. PANSHIN. Mr. Gleske?

Mr. GLESKE. How many simulators can be supported in this country? I maintain that if the Federal Government supplies the simulators and they are wrong in the requirement for the number of simulators, one thing that is going to happen is witnesses are going to be back here every year asking for more money to operate those simulators.

Whereas in the private sector I think all we are asking for is to give us the chance to compete, and we feel that if we can compete fairly, we are confident that we will get a fair share of the market. If we misjudge, and project that there is a need for five or six simulators and there is only a requirement to keep four of them going full time, MSI is going to suffer. The point is I don't think the taxpayers ought to subsidize that kind of market uncertainty.

Mr. PANSHIN. Your comments are clear on that point. Both ShipAnalytics and Hydronautics provided information as to the cost of the types of simulators each of them are discussing here today, but I didn't see that in your remarks. Just for the sake of a complete record, what would be the approximate capital construction cost of the ship handling simulator that you have at Marine-Safety International's installations at LaGuardia?

Captain HARD. The one that we operate is a multimillion dollar simulator, but to give you an answer on how much it would cost to do the type of training in question today depends on how well that training is identified.

It hasn't been identified yet. We have heard people all day long discuss how many days and what type of a mix, but you have to sit down and look at your instructional objectives. What is going to be acceptable to the Coast Guard? Then you can determine what kind of a simulator you need.

Mr. PANSHIN. I understand your point. Mine was just if we are using dollars as one measure. I'm just trying to determine where in the range the simulator you presently have at LaGuardia falls. You said multimillion dollar.

Captain HARD. It's $2 to $3 million. Replacement value in today's numbers I couldn't give—we have added substantially to it.

Mr. PANSHIN. Marine Safety International is, I believe, unique among the panel in that they also have substantial experience in flight simulation through the parent company.

What major lessons have you learned from your experience with flight simulators that may or should apply to marine simulators?

Are there two or three points that you would stress out of that considerable body of experience?

Mr. GLESKE. I think the key thing is to define the objectives of what is trying to be accomplished. Starting with the student pilot and training an airline transport pilot requires considerably different simulator sophistication.

I would like to compare a student pilot with a midshipman. One would not take a very sophisticated simulator to teach basic skills to a student pilot. The question came up earlier this morning.

Instrument procedure training is done on a part-task trainer. Some people call that a simulator, but the point is it is a somewhat simplified device compared to the simulator upon which the airline transport pilot receives his training.

One other point that I really didn't stress. There is still nothing like hands-on experience. Simulation is not going to be the end all be all.

I would suspect that in the future marine simulators could be used to evaluate, whether a candidate is qualified for a certain license.

Mr. PANSHIN. How are simulators used in the initial training of pilots?

Mr. GLESKE. As I mentioned, for the student pilot they are relatively simple devices used to teach instrument procedures.

In the more advanced training sophisticated simulators actually duplicate the feel of the aircraft.

In these simulators, the cockpit is laid out identically to a specific type of airplane. One can receive training that would be dangerous to do in the airplane The whole purpose is to expose that person's judgment or decisionmaking to what is required in various critical situations.

Mr. PANSHIN. Would that be called a full-mission simulator?

Mr. GLESKE. Yes. My definition of a full-mission simulator is one that covers all the crew duties of the command section, whether it's the bridge of a ship or a flight deck of an airplane.

Mr. PANSHIN. You were here this morning when Admiral Bell spoke, and then during the ensuing discussion, and I am sure you heard and noted his characterization of simulators. From your background in aviation, do you find that an accurate characterization?

I believe that as I heard it, his point was that in aviation the difference is that the simulators are primarily procedural, whereas in marine it's more of a unique situation.

Mr. GLESKE. Yes; I do recall that comment.

Mr. PANSHIN. In a decisionmaking context.

Mr. GLESKE. It's a mix of both, procedures and judgement but I think the bottom line is good judgment means safety. To teach someone to operate something safely, whether in aviation or not and the pilot does everything right and the correct lights come on or go out, or with a spacecraft simulator.

Mr. PANSHIN. Or the nuclear reactor operator.

Mr. GLESKE. Yes; it's a matter of trying to give someone as much experience as they can absorb in a certain specified time at their particular skill level to make the right decision.

Mr. PANSHIN. So you really see more of a similarity——

Mr. GLESKE. Yes.

Mr. PANSHIN [continuing]. Between what each of the two types is trying to accomplish?

Mr. GLESKE. Yes.

Mr. PANSHIN. Minority counsel?

Mr. LOSCH. Based on Admiral Bell's characterization of the two types of simulators, aircraft, and marine, it seemed to me it may be, although I hate to suggest something to you, it may be important to each of you to go over and talk to him or at least invite him up to your respective facilities to show him the capabilities of your various simulators.

It seemed to me that he believed that you are not going to be able to simulate all the details and the complexities of vessel operation. Perhaps it would be wise to try and encourage the Coast Guard to make some field trips.

One question for Mr. Pesch. You mentioned that you are a full-service simulation company and you are doing a lot of other things besides just training. You mentioned the Maritime Administration.

Have you established an ongoing relationship with the Maritime Administration for development of needs for simulation?

Mr. PESCH. We have been a contractor to the Maritime Administration, both in our prime and subcontract roles for a number of years, dating back to the late 1960's. The principal study which I referred to, namely the study conducted for the Coast Guard and the Maritime Administration, is called Certification and Training. It defines the characteristics of a major simulator for the master's and chief mate upgrading level based on the skills and knowledges required to be trained. As Captain Hard pointed out, it has been laid out and defined in that context.

The simulator fidelity characteristics have been defined. They include the need for color. The size of the field of view, the need for maneuvering targets, day versus night capability, the need for the careful design of the instructional facilities, and the critical variables which must be included. All characteristics have been defined in the context of a research program at the cadet level as well as master level.

Mr. LOSCH. Is this a major portion of your work?

Mr. PESCH. A major portion?

Mr. LOSCH. Yes; what percentage of your total operations are related to Marad?

Mr. PESCH. To Marad?

Mr. LOSCH. Yes; what I am trying to get at, how much training do you do and how much Marad/Coast Guard investigations or studies?

Mr. PESCH. We would be characterized as a major company in that area.

Mr. LOSCH. A major portion of your business?

Mr. PESCH. No; I wouldn't say it's a major portion of our business. I would say it's approximately 30 percent of our business, maybe 25 percent.

Mr. LOSCH. And the rest of your business is training?

Mr. PESCH. The rest of our business relates to work for the Navy, relates to work for commercial ship operators, work for the major

maritime unions, we are under direct contract to all those segments of the marine industry.

As far as segments, the Naval Training Equipment Center is one of our major clients; we have a $3 million contract there; for example, in the training area.

Mr. LOSCH. So about a third of your business is Marad or Coast Guard related?

Mr. PESCH. That would be accurate.

Mr. LOSCH. For their R. & D. divisions?

Mr. PESCH. Yes.

Mr. LOSCH. Do you expect that relationship to continue?

Mr. PESCH. I would hope so.

Mr. LOSCH. Is your headquarters in Niantic?

Mr. PESCH. No; we are in North Stonington, and we also have a field office in Long Island and we have a field office in Washington and Norfolk.

Mr. LOSCH. And you just retained Martin Pitkin in your organization?

Mr. PESCH. That is correct.

Mr. LOSCH. In what capacity?

Mr. PESCH He is a Washington office representative.

Mr. LOSCH. Will he solicit contracts for your organization?

Mr. PESCH. No; as a matter of fact he is precluded from any interaction in his previous capacity at all by our own employment contract.

Mr. LOSCH. Very good.

Thank you very much.

Mr. PANSHIN. I have no further questions, but simulators are an extremely important part of today's discussion and also a topic that is relatively new to this subcommittee.

I am wondering if any of the panelists have any concluding remarks that they would like to make which they think might be useful to the subcommittee as it compiles its hearing record today?

Mr. Miller?

Mr. MILLER. No; I don't think so.

Mr. PANSHIN. Mr. Gleske?

Mr. GLESKE. I just want to close with an invitation to the chairman, members, and the staff of the committee to visit us. We would be happy to show you our marine simulators and flight simulators that are nearby.

Mr. PANSHIN. Thank you.

Mr. PESCH. I second that.

Captain HARD. I think it's very important that before any regulations are written or conclusions reached as to what type of simulators are needed, a better understanding must be achieved of simulators available and the objectives to be met.

One unsolicited comment: I happen to be a Kings Point graduate, and I think one of the best things that has come along in the maritime training field is Kings Point's dual-license program. I think it's the future of the American maritime industry, and I would hope that this committee could do everything in its power to see that program survives no matter what the impact of the IMCO convention on seatime requirements.

Mr. PASHIN. Thank you, Captain Hard.

Mr. Pesch, I don't know if you were able to complete your remarks. We did hear your invitation.

Mr. PESCH. I just said I second Mr. Gleske's comment. You are welcome at any point in time to visit our facility in North Stonington.

Mr. PANSHIN. Thank you, and I thank all of the panelists.

The subcommittee does have one final witness, and I would like to call him at this time.

Mr. Ed Kelly of the Marine Engineers Beneficial Association, District 2, scheduled on the panel earlier today, but not able to be here at that time.

Mr. Kelly, welcome, and may we have your summary please?

STATEMENT OF ED KELLY, MARINE ENGINEERS BENEFICIAL ASSOCIATION, DISTRICT 2; SPECIAL ASSISTANT TO THE PRESIDENT

Mr. KELLY. While extending invitations I would like to extend an invitation to visit our training facility in Brooklyn, N.Y., and the training facility that we have at Toledo, Ohio.

I am sorry I am late. I was told that I wouldn't get on before 3 o'clock, and I arrived a little earlier when Captain Rich was on.

Mr. Chairman and members of the subcommittee, I am Edward V. Kelly, special assistant to the president, District 2, MEBA-AMO. As you know, District 2 is a union representing masters, mates, engineers, and radio officers aboard U.S.-flag ships engaged in foreign commerce and those that sail on the Great Lakes, and the inland waters of the United States.

Mr. Chairman, we are grateful to you and the other members for giving us the opportunity to express our views on maritime training in the United States, particularly on the 1978 International Convention of Standards of Training, Certification, and Watchkeeping for Seafarers. Incidentally, I was informed this is the first IMCO convention which recognized that properly trained personnel are essential to safety of life at sea and protection of our environment.

Our union has always been interested in training and safety—you have probably seen our motto—"Safety is Good Engineering." There is no doubt that safety is a direct result of the quality of a mariner's training and we are proud of our record. We are extremely interested in the quality of training at Kings Point and the various State academies. If the Federal government is making a commitment to maritime education, and we believe it is, we believe the academies should have topnotch leadership, the finest facilities, and the best training equipment. Incidentally, we would like to add that the Maritime Administration made an excellent choice in selecting Tom King as Superintendent of Kings Point—we are confident his leadership will keep Kings Point preeminent in maritime education. We also believe improvement in training at Kings Point will result in improvement at the State academies.

Mr. Chairman, like other maritime unions we have our own training schools—one in Toledo for the Great Lakes and one in New York for the deep sea—which enable our members to take courses leading to promotion or upgrading of professional skills. But, as a union, we depend primarily on the Federal and State

academies for the majority of our entrants or original licensed applicants. Therefore, we have a direct interest in the quality of training and education at the academies in order to provide our companies with the best trained personnel available in the world.

In addition to the academies, Mr. Chairman, as you are probably aware District 2 has and will continue to turn out original third mates and engineers both in the New York and Toledo schools. We feel that union schools are more flexible and faster than the academies in selecting and training needed third mates and engineers. For instance, during the Korean and Vietnam war we turned out the third mates and engineers in a very short period without which needed military supplies would not have been delivered or would have been carried on ships staffed with foreign officers. At present the academies do not have this flexibility. We also believe as a union and as an industry we must give the unlicensed personnel the opportunity to get out the forecastle and come up through the hawsepipe in the American tradition of self-improvement and reward to the enterprising. There has been a tendency in the past to spend too much time on the individual who has the money to enter a State school or the marks to enter Kings Point, and not enough time on the young man who is willing to make the sea his career by starting out as an unlicensed seaman. Many of our best officers both sailing and ashore in the industry have come up through the hawsepipe and, if our schools were not available these men may not have had the opportunity to raise themselves to licensed positions. We also believe that in a democratic society the ideal ship is one manned with a mixture of licensed officers from the schools and the forecastle.

We talked about the quality of training in the U.S. maritime training schools and, as I mentioned earlier, the United States has the best trained entry mates in the world. during the STCW convention we worked to raise the training level of foreign flag third officers to a level found in America: if these standards are approved and then followed by all the seafaring nations we will have made a giant step forward in improving the safety at sea and protecting our environment.

As we see these new standards, other nations will be required to revise their laws governing training but we will only have to address the requirement of additional seatime for the prospective third officer, something which should have been done a long time ago. By using the equivalency provision of the convention, the 1-year seatime is not critical to prospective American third officers. This provision gives American officers flexibility by allowing them to put together combinations of approved equivalent trainings to meet this seatime requirement. One of the principal methods for acquiring that equivalent service is training on simulators.

However, as experienced mariners, we know that equivalent training, including that on simulators cannot replace the need for sailing experience. It is our opinion that every effort should be made to provide the prospective third officers as much actual sea time as possible. We believe simulators should be used only after a prospective third officer has spent a minimum of 6 months on bridge watch under a U.S. Coast Guard licensed officer's supervision. This would be the most effective point for training on simula-

tors. Furthermore, the equivalency clause should not be used to lower our standards of training nor should it be used to justify the purchase of expensive simulators until requirements are clearly defined. The cost of operating and maintaining ships, particularly training vessels, is increasing and we hope the schools do not cut back on seatime. The easy way out is to go all out for the simulators—but we feel the simulator will not replace the much needed time at sea. We would prefer monies be appropriated to the schools to acquire small craft with ship-handling characteristics scaled to large vessels and a pilothouse equipped with all the navigational aids generally found on modern vessels. These craft should have a priority over the acquisition of the simulators.

Simulators have a place in maritime education and training. They are a valuable aid to training, particularly for masters, senior deck, and engineering officers, and harbor pilots and, as mentioned earlier, they have their place in training the experienced prospective third officer. But, this hands-on experience can only be gained at sea.

As mentioned earlier, every effort should be made to get the prospective third officer to sea as often as possible, even if this requires paying nonsubsidized companies money to carry our future officers. We feel that MarAd should make an allout effort to get every U.S.-flag ship to carry cadets. We also feel strongly that cadets should not be carried aboard foreign-flag vessels, particularly those that are manned by officers not licensed by the Coast Guard.

Thank you—I would be pleased to answer any questions.

Mr. PANSHIN. Very good; and may I apologize for the problem in communicating with you as to the time you were expected to have been on the panel.

I am sorry for that difficulty.

Captain Rich earlier today testified that in his opinion, continuing education is a program that the State and Federal academies should not enter into.

Do you have any comments on that?

Mr. KELLY. We feel that the union schools of continuing education are excellent ones, and we also feel that the union schools, our school in particular, can work with the academies using their facilities to upgrade our members.

Mr. PANSHIN. Such as for courses which you in cooperation would run with them using their facilities?

Mr. KELLY. That is right.

Mr PANSHIN. As contrasted with programs which they run entirely by themselves?

Mr. KELLY. That is correct.

Mr. PANSHIN. As we look at the IMCO convention and its implementation, what recommendations do you have for the possible use of simulators and smaller vessels?

Mr. KELLY. To begin with, we prefer that the individual, the trainee, should spend as much time as possible at sea. I personally believe that it should be at least a minimum of 6 months, and that the simulators should be used to supplement this training.

We feel that Marad should make every effort possible to get every U.S.-flag ship, to carry cadets. We also feel strongly that

cadets should not be carried aboard foreign-flag vessels, particularly those that are manned by officers not licensed by the Coast Guard.

I have heard testimony today where one of the companies puts its cadets aboard Liberian-flag ships. I question what license some of the officers have aboard those ships.

Mr. PANSHIN. How do you feel about the use of smaller vessels?

Mr. KELLY. We feel that this should be in accordance of priorities, seatime first, smaller vessels second, then the simulators third.

Mr. PANSHIN. By seatime do you mean deep sea?

Mr. KELLY. Deep sea, yes.

Mr. PANSHIN. Minority counsel?

Mr. LOSCH. No questions.

Mr. PANSHIN. That concludes the questioning.

Thank you for appearing, Mr. Kelly.

Mr. AuCoin is still on the floor, unfortunately. He asked me to extend his apologies and personal thanks to all of you for your contributions today and for your cooperation and patience with our proceeding.

The subcommittee will proceed to examine today's record. There will be written questions directed to some of today's witnesses. Further hearings may be held on this subject.

Again, may I extend to you Mr. AuCoin's thanks and those of the subcommittee for coming and participating in today's hearing.

The committee stands adjourned.

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Maritime Affairs
Washington, D.C. 20230

NOV 14 1980

Honorable Les AuCoin
Chairman, Ad Hoc Select Subcommittee
on Maritime Education and Training
Committee on Merchant Marine and Fisheries
House of Representatives
Washington, D. C. 20515

Dear Mr. Chairman:

This is further to our letter of October 21, 1980, concerning a number of additional questions you submitted to us as an extension of our testimony of September 9, 1980, before the Ad Hoc Select Subcommittee on Maritime Education and Training.

For your convenience, we have listed your questions and our responses on the enclosed pages. If we can be of further assistance, please feel free to contact us.

Sincerely,

BRUCE A. McALLISTER
Deputy Assistant Secretary
for Maritime Affairs

Enclosures

Question No. 1

Most of the attention during the hearing focused on the full function or ship's bridge simulator. What other types of simulators would be useful in maritime training? Should different types of simulators be installed at different State and Federal academies?

Answer

In the navigation training area, other than bridge simulators, the type of simulator most commonly in use is a radar simulator for radar navigation training. All of the academies already have, or are in the process of acquiring these simulators for radar navigation and collision avoidance training. Radar simulators are "part-task" training aids in comparison to a full-function bridge simulator. We strongly support use of radar simulators. Beyond that, for navigation training a well-equipped school should have operating models of a variety of position-fixing devices some of which might be classified broadly as "simulators", such as Loran C units with signal generators, Omega units, gyro-compass, etc.

In areas other than navigation training, simulators are very useful for instruction in subjects such as trim and stability, tanker loading/unloading and hull stress, main propulsion console operation and fault response, and centralized engine room console operation and trouble response. In any of these subjects, a number of different simulators are available or feasible, generally related to specific vendor's components as installed for actual

operation aboard ship. It is not necessary that there be uniformity among the academies either in the number or type of these simulators. Considering, for instance, the variety of main propulsion systemsand consoles in use in the fleet, it would be financially impractical for any academy to do more than select representative diesel or steam plants on which to base selection of propulsion system simulators. Funds also limit the degree of detail within any simulators which an academy may wish to procure. At the State academies, acquisition of this equipment has for the most part been financed by the States and the schools themselves, with some support by industry donations in a few cases.

With regard to different types of bridge simulators, our investigations based on third mate performance objectives are directed at developing the most cost-effective combination of features for deck cadet training purposes. A similarity of basic capabilities should be expected. There are also cost efficiencies in having a basic compatibility among the academies in factors such as computer programming, and equation parameters for major variables such as ship hydrodynamics and visual scene generation. For the salt-water academies this indicates a considerable similarity in the principle features. Where there is a significant element of difference in the performance objectives, as in the case of Great Lakes deck cadets who must have specific pilotage skills, we recognize that this may require a different level of basic capability in a bridge simulator for that purpose.

Question No. 2

What are the present life expectancies of the schoolships? If they were renovated, by how much could their life expectancies be extended? At what costs?

Answer

The present life expectancies of the schoolships and their estimated extended life expectancies if renovated are as follows:

Schoolship	Life Expectancy (Year)	Extended Life (10 yr.) (Year)
T.V. BAY STATE	1992	2002
T.V. EMPIRE STATE	1992	2002
T.V. STATE OF MAINE	1992	2002
T.V. TEXAS CLIPPER	1985	1995
T.V. GOLDEN BEAR	1985	1995

The estimated cost to extend the life of the schoolships 10 years would be $25 million over a three year period (1982-1984). The estimate by vessel is as follows:

Schoolship	Estimated Cost by Vessel for 10 Yr. Extended Life (000)
T.V. BAY STATE*	$5,400
T.V. EMPIRE STATE*	5,400
T.V. STATE OF MAINE*	5,400
T.V. TEXAS CLIPPER	3,800
T.V. GOLDEN BEAR	5,000
TOTAL	$25,000

*Sistership

Question No. 1

For Kings Point, what role will training ships, smaller vessels, and simulators play in the fulfillment of sea training? At the State academies, what role will commercial vessels, smaller vessels, and simulators play in the fulfillment of sea training? If MarAd builds two new training ships, how will this change?

Answer

The U.S. Merchant Marine Academy provides approximately ten (10) months of sea time on commercial vessels. To comply with the IMCO requirement for one (1) year's sea training, we are planning to provide the equivalent of two (2) additional months training on small vessels and by simulator training when a bridge simulator becomes available for training use. This simulator training could be a shared use of an acquired unit serving both the SUNY Maritime College and Kings Point.

At the salt-water State academies the requirement could be met by a combination of training vessel time, training on bridge simulators, small vessels and craft, commercial vessels and other types of training such as specialized training extending the use of radar simulators. The mix of elements may vary from school to school. The suitability of any particular mix will be determined after a proper evaluation of the training syllabus, equipment and facilities.

Construction of two new training vessels would not otherwise affect the mix of elements for providing the necessary sea training. Merely to provide the current 6 months of sea time would utilize from 80%-90% of the available time of the two new training vessels.

Question No. 4

Does MarAd anticipate a request in the next budget cycle for small craft at the State academies to serve as training vessels?

Answer

We are not contemplating such a request at the present time. We are exploring availability of suitable small craft from within Government.

Given the enactment of the Maritime Education & Training Act of 1980 (P.L. 96-453) and the specific authorities it provides to the Maritime Administration in making excess or surplus craft available to the academies (Sec. 1308(b)) and the authority to Coast Guard for inspection of training vessels (Sec. 1308(e)(1)), we intend to explore this alternative before requesting funds.

Question No. 5

When a cadet sails on a merchant vessel, who oversees the completion of his or her academic project during the time at sea? Does the Coast Guard in cooperation with Kings Point set guidelines for this?

Answer

The U.S. Merchant Marine Academy sets the guidelines and oversees the completion of the Sea Project. While the Coast Guard administers the original licensing examinations and issues the licenses it does not set the guidelines relative to the Sea Project. The U.S. Merchant Marine Academy has detailed sea-project directives and requirements for its Midshipmen and a separate Department of Shipboard Training including Academy Training Representatives in the ports of New York, New Orleans and San Francisco, to supervise this aspect of the Academy's program. While on board commercial vessels deck cadets are supervised by the Chief Mate and engineering cadets are supervised by the Chief Engineer.

The Maritime Administration is responsible for all aspects of the Kings Point curriculum. However, there is a practice of close cooperation with the Coast Guard.

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Question No. 6

Sea-Land, in a statement submitted to the Subcommittee, suggests that the most cost-effective means of meeting the increased sea training requirements would be to "support an expanded at-sea training activity on board commercial vessels." Is this an option you would consider?

Answer

The Maritime Administration did consider the use of commercial vessels for sea training, as part of our earlier study of alternatives to training ship construction. That study is titled: Alternatives for Sea Training of State Academy Cadets - A Life Cycle Cost Approach, February 1979, and has been supplied to the Subcommittee.

Although the study investigated the alternative of all State academy cadets (other than the Great Lakes Maritime Academy) achieving 12 months seatime aboard commercial vessels the base data developed in the study are adaptable to consideration of providing six months incremental sea time for only the deck cadets of the five salt-water State academies.

Subsidized ships normally provide two cadet berths for a total of 326 available berths on 163 ships. The study showed that by doubling up cadet quarters occupancy, or adding cadet quarters on those ships where this is feasible, 540 berths could be available on the 120 ships built with CDS since 1965. To this should be added approximately 60 berths on CDS-built ships constructed prior, which cannot be doubled-up, for a total of

approximately 600 berths available in the CDS-built fleet. However, scheduling interactions between cadet and ship availability limits utilization of available berths to 60-70 percent under normal conditions. At 70 percent utilization (the study uses 60 percent) the maximum capability of the augmented number of cadet berths would be 455 cadets.

Against this number, the U.S. Merchant Marine Academy, which is totally dependent on commercial sailing, requires berths for at least 280 midshipmen year-round. The number of deck cadets at the five salt-water State academies, if they were to sail for six months at a time in two groups in either their second or third class year, would create an additional year-round demand for 175 berths.

The total demand for berths is barely matched by supply only with substantial doubling-up and addition of quarters where feasible. Simply put, berths are just not available in sufficient numbers. Additional berthing would have to be provided in the existing fleet and in new construction.

Also, it should be noted that with the enactment of the Maritime Education and Training Act of 1980 (P.L. 96-453) the Government would incur substantial expenditures if we place State academy cadets on commercial vessels as a program action. Section 1304(c) of the Act provides in part that "While traveling under orders for purposes of receiving training under this paragraph [on board commercial vessels or in shipyards, plants or industrial or educational organization], any individual who is attending a

State maritime academy shall receive from the Secretary allowances for transportation (including reimbursement of traveling expenses) in accordance with any regulations promulgated by the Secretary." It is estimated that this would require an annual expenditure for travel of about $93,100 based on current travel rates. Additionally, cadets would be paid $375.60 per month (current rate) and be furnished with quarters and subsistence by their steamship company employers while assigned to merchant vessels. The total of these costs, to provide an additional six months sea time to State academy students, is estimated to be in excess of $1.35 million per year at current rates. These costs would have to be subsidized by the Government in one way or another.

The State academies are currently authorized to utilize commercial vessels as a substitute for up to two months of the existing six-month training ship sea time requirement. We continue to encourage the academies to seek assignments for their cadets on commercial ships on a voluntary basis. However, from a standpoint of a program alternative for the incremental six months of sea time required under the IMCO Convention, other alternatives (bridge simulators and small training craft) are considered to have greater training effectiveness potential and to be less disruptive of the academies' programs.

Question No. 7

Did MarAd make a thorough evaluation of our Reserve Fleet before deciding upon the GEIGER as the best vessel available for Massachusetts Maritime Academy? If this vessel was the best available, what does this say about the state of our Reserve Fleet, particularly with respect to our National Defense needs and the needs of our Maritime education programs? Was the GEIGER typical of the state of most of the vessels in the fleet?

Answer

MarAd, together with Massachusetts Maritime Academy, made a thorough evaluation of prospective training vessels before the selection of the USNS GEIGER as a training vessel. The Massachusetts Maritime Academy requirement for berthing 800 cadets, and its training space needs, are such that other ships in the National Defense Reserve Fleet were clearly inappropriate for consideration as Academy schoolships. The Superintendent of Massachusetts Maritime Academy, Admiral Harrington, by letter of October 10, 1978, stated that a thorough search had been made for potential training ship replacements. As part of this search, MarAd staff joined the Academy's staff members to visit the San Francisco Bay area to inspect the S.S. MARIPOSA, USNS VANGUARD and USNS GEIGER. Admiral Harrington concluded in his 1978 letter that the most viable schoolship replacement candidate was the USNS GEIGER.

To insure a complete evaluation of potential schoolships, MarAd in 1979 identified three additional vessels to Massachusetts Maritime Academy for consideration as possible replacements for the BAY STATE. The vessels identified were the USS TULARE, USS FRANCIS MARION, and USS PAUL REVERE. These are C4 Mariner type ships built about 1953 by the Maritime Administration and converted for naval service. A group of Massachusetts Maritime Academy representatives (including alumni) and MarAd representatives visited the USS TULARE, and for comparative purposes the USNS GEIGER (for the second time) in San Francisco on August 21, 1979. The conclusion of the visiting group, with no dissents, was that the GEIGER was the best ship for the task; that a major conversion to increase passenger capacity to accommodate Massachusetts Maritime Academy's 800 cadet requirement would be necessary to make the USS TULARE suitable as a schoolship. The cost of such an undertaking was deemed prohibitive ($6 - $8 million) and the time required for activation was estimated to be at least five months longer than for the GEIGER. The need to have the replacement training ship at Buzzards Bay between June 1 and 23, 1980, for the 1980 training cruise was forcefully and repeatedly stated by the Academy to be of paramount importance to Academy programs and accepted by MarAd as a target for delivery of the GEIGER to Buzzards Bay.

The vessels USS FRANCIS MARION and USS PAUL REVERE were also visited and comparative costs for activation/conversion of these vessels versus the USNS GEIGER were developed by MarAd's Office of Ship Operations. The USS PAUL REVERE activation/conversion cost estimate came reasonably close to the estimate for the USNS GEIGER. However, while the REVERE and the MARION were being studied, the Navy was forced to withdraw them from consideration.

Thereafter, at the request of the Academy arrangements were made for Academy personnel (and alumni) to visit USNS GEIGER a second time to identify needs for its use as a training vessel based on experience derived from the Academy cruise on a sister ship in 1978. On October 23, 1979, Admiral Harrington, in a telegram to Assistant Secretary Nemirow, repeated his 1978 request for the USNS GEIGER as a replacement for the T.S. BAY STATE.

The GEIGER was the only vessel that was suitable as a training vessel. The Massachusetts Maritime Academy requirements for berthing 800 cadets, plus its need for training space, were such that other ships in the NDRF were definitely not viable candidates. The GEIGER is not typical of the ships in the NDRF, most of which are cargo ships laid up by MarAd under MarAd specifications. It is a passenger vessel laid up by the Navy under Navy specifications. However, it was activated in time to meet the Academy's cruise commitments. It was certified by the U.S. Coast Guard and classed by the American Bureau of Shipping. It was delivered to the Academy after successful dock and sea trials and a successful 2,000 mile delivery voyage from New Orleans.

With the activation of the GEIGER, there are now no vessels in the NDRF that can be used as replacements for the Maritime education programs without a major conversion.

Question No. 8

You testified that $3.5 million was not adequate to renovate the GEIGER. Was it not MarAd that made this original estimate? How was this figure arrived at?

Answer

MarAd made the original $3.5 million estimate to activate the USNS GEIGER in the fall of 1978 based on information assembled during the summer of 1978. The estimate reflected information from a condition survey report conducted at the time of lay-up, inspection of the vessel, anticipated Coast Guard and ABS regulatory requirements necessary to certify the vessel with the USCG and to place the vessel in ABS Class; an allowance for unknown extra work requirements discovered in the opening and inspecting of the machinery plus modifications requested by Massachusetts Maritime Academy to improve training and habitation. The Maritime Administration was not in a position to change the estimate once it was introduced into the legislative process. Cost escalation factors reflecting inflationary increases in the costs of labor and materials pushed costs beyond $4,000,000 by the time the activation was accomplished in mid 1980.

Question No. 9

You testified that certain specifications were required in the contract MarAd signed with Boland Marine. Why was something as basic as a sanitation system not required by this contract?

Answer

The installation of a marine sewage device was included in the bid specifications. However, due to funding limitations and with the U.S. Coast Guard's agreement to waive this requirement until FY 1981, it was decided to postpone its installation until after the cruise.

Question No. 10

The Coast Guard found 39 deficiencies in the BAY STATE after Boland Marine completed its work. Should these deficiencies have existed given the terms of your contract with Boland Marine? Were you satisfied with the work done by Boland Marine? If not, why was the vessel allowed to leave New Orleans?

Answer

The T.V. BAY STATE left the Boland Marine yard in New Orleans in Class with ABS and certified by the U.S.C.G. The Coast Guard deemed that these deficiencies were not sufficiently serious in nature to preclude the delivery voyage of the vessel to Buzzards Bay. Thus the Academy could begin preparing the ship for the cruise while the remaining deficiencies were being rectified after the vessel's arrival at Buzzards Bay. These deficiencies, along with others identified by MarAd and Academy personnel during the shake down delivery voyage, were corrected. In any activation of a vessel after an extended lay-up, deficiencies may develop during the shake down period that were unknown at the time of activation. These items are not the responsibility of Boland Marine

The Maritime Administration was satisfied with the work accomplished by Boland Marine. To test the results of that work, the MarAd contract provided for a dock trial of the ship's power plant and a sea trial. Both trials were observed by representatives of the Massachusetts Maritime Academy, the Coast Guard, and the American Bureau of Shipping and were judged successful. The contract also provided that Boland conduct the shake down delivery voyage from New Orleans to Buzzards Bay. Massachusetts maritime personnel were present at the Boland yard, or on board the ship, from about ten (10) days before the dock trials began through the contractor's shake down/delivery voyage. MarAd inspection personnel also made the voyage. In addition, the contractor was required to retain his delivery crew on board for 48 hours after delivery of the ship to the Massachusetts Maritime Academy at Buzzards Bay to facilitate the delivery/ transition.

Question No. 11

In light of the problems discovered on the BAY STATE after Boland Marine completed its work, are you satisfied with the inspection procedures employed by MarAd?

Answer

The Maritime Administration had two inspectors on a full time basis to monitor and oversee the activation and repair work on the BAY STATE. All repair and activation work had to meet the approval of these inspectors. No work was accepted until it had been inspected and approved by a MarAd inspector. In addition, both ABS and U.S.C.G. had inspectors on the job to assure that all work met their requirements. As with most vessel activations, MarAd, U.S.C.G., and ABS inspectors are jointly present to witness testing, inspections and completion of each item "put-in-hand." MarAd is satisfied with the inspection procedures.

When the vessel left Boland Marine a successful sea trial was conducted, followed by a successful 2,000 mile delivery voyage from New Orleans to Buzzards Bay. The problems that occurred on the BAY STATE followed the delivery of the vessel to the Academy. All repairs required by U.S.C.G. and identified by MarAd and Academy personnel during the contractor-manned delivery voyage were accomplished prior to the first cruise departure from Buzzards Bay. The "eel grass" problem was clearly

operational and not related to the activation of the ship. The grass was drawn into the ship's circulating/cooling water system at the Academy berth and sharply restricted the flow of cooling water to the steam auxiliary power plant which provides electricity for the ship.

The restricted water supply reduced the vacuum in the auxiliary condenser to 18" of mercury versus a normal 26 to 27 inches. The lower than usual vacuum was accepted by the Massachusetts Maritime Academy crew and this set the stage for the power failure which was to follow.

Prior to the vessel's departure from Buzzards Bay, the MarAd engineering surveyor (a former Chief Engineer) who had been observing and inspecting repairs, had informed the Chief Engineer that the leaking crossover valve should be repaired. The Chief Engineer (who was replaced shortly after the eel grass incident) decided that the valve should be repaired at sea after the vessel sailed, and the ship sailed with the leaking valve.

The MarAd engineering surveyor also advised the ship's engineering force prior to sailing that, because of the leaking valve, it would be necessary to shut down the electric fire pump to inspect and clean the condensers, and that a diesel driven auxiliary fire pump would provide adequate fire main service when the electric pump was shut down. However, at that time the auxiliary plant was shut down because of the restricted flow of cooling water.

Therefore, the ship's force did not follow this procedure and thus they were unable to open the condensers for inspection.

As the ship got underway, eel grass was drawn into the condensers. The decreased water flow could not condense the steam from the turbine at the necessary rate making a shut down necessary to prevent major damage. Electricity was then supplied by a 600 kw auxiliary diesel. Following the steam plant shut down, initial attempts to open the condensers for inspection were frustrated by water pressure behind the inspection plates. This pressure was caused by the leaking crossover valve from the fire main into the condenser water system as the fire pump continued to operate on power from the auxiliary diesel generator. Thus, there was considerable delay in identifying the cause of the condenser water pressure problem. This further delayed opening the condensers for removal of the eel grass. The impact of the leaking crossover valve on the condenser water system was again identified by the MarAd engineering surveyor the next morning when he boarded the ship via tug.

Question No. 12

Whose responsibility is it to see that money appropriated by the Congress for renovating training vessels is spent wisely? Was that responsibility met in this instance?

Answer

The responsibility for the management of programs to renovate training vessels come under the auspices of the Maritime Administration. It is MarAd's responsibility to assure that funds for these programs are spent wisely.

With respect to the USNS GEIGER, funds for its activation were spent judiciously. The entire NDRF was canvassed several times to determine what vessel or vessels would be capable of accommodating the 800 man (officers, crew, and cadets) requirement of the Massachusetts Maritime Academy (MMA). The GEIGER was identified as the sole viable candidate for MMA's schoolship replacement. Based upon a condition survey, the existing maintenance and repair history of the vessel, knowledge of lay-up procedures in effect, and the Maritime Administration's experience in activating vessels, a cost estimate to reactivate the GEIGER was calculated. It should be stressed that this type of estimate is necessarily tentative in the case of a vessel laid up for close to 10 years and inspected with machinery in an idle status and not opened for inspection.

The GEIGER underwent drydock repairs at the Todd Shipyard in Alameda, California and topside repairs at Boland Marine, New Orleans.

During the entire activation period the vessel was attended by a U.S. Coast Guard inspector and/or an American Bureau of Shipping (ABS) representative.

After the repair and activation work was completed at Boland a sea trial was held with the U.S. Coast Guard and ABS in attendance. The GEIGER completed the sea trial successfully, obtaining certification from both the Coast Guard and ABS.

Following the successful sea trial the GEIGER was steamed by the contractor's crew from New Orleans to Buzzards Bay (site of MMA's Schoolship berth), a distance of close to 2,000 nautical miles and delivered to MMA with the contractor's crew remaining onboard at Buzzards Bay for 48 hours to facilitate the transfer of the ship.

Those deficiencies uncovered prior to and during the sea trial, and during the subsequent voyage to Buzzards Bay that had significant seaworthiness or safety implications were remedied as required by the Coast Guard before the BAY STATE started her 1980 summer training cruise.

DEPARTMENT OF TRANSPORTATION
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5730

14 NOV 1980

Honorable Les AuCoin
Chairman
Ad Hoc Select Subcommittee
on Maritime Education and Training
721 House Annex 1
Washington, D.C. 20515

Dear Mr. Chairman:

Enclosed you will find the responses to the questions posed in your letter of 8 October 1980.

I trust you will find the answers responsive, and aid the Subcommittee in addressing important questions in the field of maritime education and training.

Sincerely,

LARRY S. CRAIG
Liaison Officer, U.S. Coast Guard
By direction of the Commandant

Encl: (1) Responses to Chairman AuCoin's questions contained in his letter of 8 October 1980

Responses to Congressman Aucoin's letter of 8 October 1980 pertaining to Maritime Training

Q. 1. Regarding the licensing process, how does the United States Coast Guard administer requirements for licensure? In other words, what criteria do you use in determining whether a person is qualified to sit for the third mate or third assistant engineer license exam?

A. The criteria utilized to determine an individual's eligibility for examination for third mate or third assistant engineer are based upon the statutory provisions of 46 U.S.C. 228, 229 and 672a. Eligibility requirements for the specific licenses are set out in regulation and are concerned with:

(a) the nature and extent of sea experience;

(b) satisfactory completion of optional training programs;

(c) citizenship (U.S.); and,

(d) the character of the individual.

Q. 2. Do licensing criteria differ for graduates of the U.S. Merchant Marine Academy, the state maritime academies, the union schools and the officers who work their way up through the hawsepipe? Please be as specific as you can.

A. Citizenship and character requirements are the same for all individuals applying for a license as third mate or third assistant engineer. Physical requirements for all applicants are essentially the same as well; the primary difference being in the visual acuity standards for mate and engineer licenses. The training and sea service criteria for individuals graduating from the academies, union school graduates and those individuals coming through the hawsepipe vary depending upon the amount and type of training received. As the following table indicates, under the regulatory licensing scheme, training received through Coast Guard approved training programs may, to a certain degree, be substituted for sea service experience:

QUALIFICATIONS FOR THIRD MATE OR THIRD ENGINEER

Training	Sea Service Experience*
Graduation from U.S. Merchant Marine Academy	Academy curriculum includes approximately ten months service on ocean or coastwise vessels of 1000 gross tons or over while enrolled at the institution.
Graduation from state maritime academies (except the Great Lakes Maritime Academy)	Academy curriculums include approximately six months service on training vessels while enrolled at the particular institution (two months of which may have been obtained upon commercial vessels).
Completion of prescribed course at approved maritime union schools	Programs include approximately ten months service on ocean or coastwise vessels of 1000 gross tons or over.
Individuals receiving no formalized training	Three years service on ocean or coastwise vessels of 1000 gross tons or over.

*NOTE - Service experience for engineers is based upon mode and horsepower of vessel propulsion.

Q. 3. Are licensing requirements set forth for each of the above groups in regulations? If not, why?

A. Licensing requirements for each of the groups noted in question number two are found in 46 CFR 10.02, 10.05-33, 10.10-21 and 10.10-23.

Q. 4. How do these requirements compare with the training given students at the Coast Guard Academy and other service academies? Will IMCO requirements apply to them? If there are differences, please explain.

A. The regulations only require graduation from one of the listed institutions or training programs. In this respect, graduates of the Coast Guard or Naval Academies are treated in the same manner as their contemporaries from the Merchant Marine Academy or state academies. The provisions of the International Convention on Standards of Training, Certification and Watchkeeping of Seafarers, 1978 (STCW 78) will have no direct affect on the service academies' programs as the Convention does not apply to warships, naval auxiliaries, or state operated vessels in non-commercial service (see Convention ARTICLE III). There will be an effect on the individual in that a Coast Guard or Naval Academy graduate will not automatically qualify for examination for a third mate or third assistant engineer license as is now the case. This statement is made on the assumption that each institution continues its present sea training program.

Q. 5. Who prepares the Coast Guard licensing exam? Are the exams generally accepted as an effective indicator that a person who passes has the requisite knowledge to function as a third mate or third assistant engineer?

A. Our license exams are prepared at the U.S. Coast Guard Institute, Oklahoma City by the Merchant Vessel Personnel Branch. This branch consists of eight U.S. Coast Guard officers, (nine are authorized) seven of whom hold U.S. Merchant Marine Officer licenses. Working with these officers are six civilian employees, two of whom are licensed U.S. merchant marine officers. Also included in the six civilian employees is a personnel research psychologist who has a masters degree in psychology with a major in testing and measurement. The satisfactory completion of the examinations is considered to be an accurate measure of the applicant's ability to perform as a third mate or third assistant engineer.

Q. 6. You testified that you foresee allowing a portion of at-sea time to be acquired on

small vessels and simulators for the deep-sea license. How will this be acknowledged? In written regulations?

A. The use of small vessel training and simulators as a substitute for a portion of the required sea training has only been approved in principal. The use of "small vessel" training presents no problem when related to the Convention as it does not stipulate a particular size (gross tonnage) vessel upon which the required sea service must be obtained. Although the use of vessels of less than 1,000 gross tons would be a departure from Coast Guard policy, we believe its limited use can be accepted. There is little question that a small vessel and/or simulator training program can be of more value than a day-for-day trade off for straight sea time. These types of training can be intense and repetitive. Situations may be introduced which a prudent master would hesitate to undertake with a large vessel. To be truely effective, the training must be defined in terms of goals to be achieved in relationship to other instruction; how the training will be delivered in terms of training aids and instructors; and how it will relate, or be reenforced, by at sea experience. How much value can be placed on this training is a question that cannot be answered until specific proposals are forthcoming showing the intregration of these types of training into the overall program. The mechanism to acknowledge the acceptance of these types of training will be by Coast Guard approval letter to the particular institution. When directed to either the Academy or one of the state maritime academies, consultation with the Maritime Administration shall be undertaken prior to issuing the letter.

Q. 7. How were the lower limits of 1000 tons and 4000 horsepower arrived at for the so-called "unlimited licenses" for present licensing purposes?

A. The origin of the 1000 gross ton applicability to "unlimited" deck licenses is somewhat elusive to track down. In this area, our response must be based on a certain amount of deduction as our immediately available regulatory records only go back to 1938.

The year 1940 marked the initial issuance of the Coast Guard's predecessor agency's regulations in the then new Federal Register. This initial publication contained those regulations in effect as of 1 June 1938, and the 1000 gross ton limitation was found in connection with the issuance of certain deck officer licenses.

In searching further, a review of the vessel manning and licensing statutes reveals the 1000 gross ton figure is found in 46 U.S.C. 223. As used in this statute, ocean and coastwise mechanically propelled vessels of 1000 gross tons and upward are required to have three watch standing mates. This statute is based on the Act of May 11, 1918, which in turn is based on the Act of March 3, 1913. (The only difference between these two Acts was the addition of a certain type of vessel to the list of exceptions which is of no consequence to this question.) Accordingly, we are led to believe the 1000 gross ton figure is derived from the 1913 and 1918 statutes. It should be pointed out that ratification of the International Conference on Training, Certification and Watchkeeping of Seafarers, 1978 (STCW 78), will cause this level to rise to 1,600 gross tons; a figure considered to be realistic in light of the growth of ship size.

The information concerning the horsepower criterion for engineer officer's unlimited licenses is easier to determine. Unlike the deck officers, there is no definitive statutory source. 46 U.S.C. 224, the statutory authority to issue the engineer's license, charges the Coast Guard to be "satisfied" with among other things, the applicant's "experience". The statute also provides the authority to establish various classes of engineer officers. Accordingly, the horsepower criterion is considered a logical and proper translation of the statutory charge.

The regulatory execution of this standard is traced as follows:

(a) Returning again to the initial publication of the Federal Register Regulations. It is found engineer licenses were restricted to waters (ocean, coastwise, Great Lakes etc.), vessel tonnage (750 and 1500 gross tons mentioned) and mode of propulsion (steam or motor) with no specifics as to horsepower (HP).

(b) As non-condensing steam powered engines disappeared, and horsepower of the installations rose, the old limitations no longer appeared to be realistic. By 1948, a 2,500 HP division line was formed between "Limited" vs "Unlimited" licenses. The existing distinction between steam and motor was continued. Criteria to change from the "old" to the "new" system are also enumerated.

(c) Advancing technology rendered the 2,500 horsepower standard unrealistic, and a 4,000 horsepower criteria evolved in 1956, which is still recognized today.

It should be pointed out that this 4000 HP standard is <u>not</u> designed to be an exact representation of the average horsepower of a modern vessel. It is only used to indicate that, in general, engineering installations equal to or greater than this standard will have characteristics adequately similar to permit the person

concerned to competently discharge his or her duties. This standard (and philosophy) is internationally accepted based on the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW 78). Although the convention does use a different designation, 3000 kW propulsion power, it is equivalent to our domestic standard of 4,000 HP.

Q. 8. If simulator time will be allowed to satisfy a portion of the sea-training requirements, what plans are there to allow laboratory time -- dockside or ashore -- to satisfy a portion of this requirement?

A. Laboratory time, either dockside or ashore, will not be accepted as a substitute for sea time. This type of training is envisioned as falling within the allowable two years of instruction permitted by the Convention. The primary advantage of the simulator is that it has the capacity to "generate" situations which are infrequently encountered or can't be safely conducted at sea. Further, the simulator enables each student to be exposed to decision making situations of an emergent nature, under safe conditions.

Q. 9. To what extent is time spent on commercial vessels spent observing in contrast to "hands-on" training?

A. The question of what is the ratio of observation time to "hands on" training on commercial vessels in regard to U.S. Merchant Marine Academy cadets, has no definitive answer. In general, each cadet is assigned to a four hour bridge or engineroom watch with a licensed officer. While on watch the cadet will perform essentially the same duties as the watchstanding officer which, by the very nature of the job, requires almost equal amounts of observation and hands-on involvement. The remainder of the cadet's daily training is spent under the direct supervision of either the chief mate or the chief engineer. This training may be in the form of additional watches, work on the cadet's Sea Project (a written work project prepared by the Academy requiring definitive answers by the cadet based upon the individual's observations and experience gained on board ship), or "daywork". Daywork for engine cadets normally consists of the hands-on maintenance of the vessel's main propulsion or auxiliary machinery. For the deck cadet, daywork may consist of deck maintenance work, such as scraping and painting, steering, or supervision of stowage or discharge of cargo. Both individuals are under the general supervision of a licensed officer while performing daywork and may receive instruction while physically performing their duties.

Q. 10. Would a training program combining the use of school ships and commercial vessels offer advantages?

A. The use of both school ships and commercial vessels is a good all-around solution as regards the obtaining of sea service. Each has its own unique set of advantages and disadvantages. Proper use of both forms of training, assuming availability tends to eliminate or mitigate the disadvantages of each type of training. Some of the more obvious problems concern availability of enough commercial vessels to accommodate cadets, lack of formally trained instructors on commercial vessels, the unpredictibility of ship schedules, and the meshing of school sessions with vessel operating schedules. A combination of both vessel types should continue to be considered to maximum extent possible for the training of future mariners.

Q. 11. How do the maritime academies of other countries intend to meet the at-sea requirements of the IMCO Convention?

A. We have been led to believe by the deliberations of the STCW 78 Conference that other countries having maritime academies do not have a problem in meeting the at-sea requirements. These countries' academies already require more than the one year of sea time, primarily to acquaint cadets with the problems of handling multinational crews with attendent language and communciation difficulties. It should also be noted that these academies, by and large, do not have degree programs and therefore are not anomalous with United States practices.

Q. 12. At present, how much time on smaller vessels may be used to count towards fulfillment of the sea-training requirement?

A. At present, service on board vessels of less than 1000 gross tons is not acceptable towards fulfillment of service requirements for license as unlimited third mate. As stated in answering question 2, graduation from a service or maritime academy is considered sufficient experience to take the required examinations. We don't foresee imposing a tonnage limitation based simply upon a small vessel training program being incorporated into the overall training. After all, the purpose of the small vessel training is to teach and demonstrate ship handling principals under relatively safe and controlled conditions. How much credit can be offered for such a program depends

upon evaluation of a specific program, none of which have been offered yet.

Q. 13. In a statement Sea-land submitted to the Subcommittee, that company claims that IMCO in itself is not sufficient to improve the safety of life and property at sea; improved licensing examinations are imperative to fit the demand of today's maritime equipment. What is your response to this?

A. Taking the Sea-Land statement at face value, I am forced to contest their perception of the purpose of the license examination program. In our view, the purpose of the examination program is to verify an applicant meets a minimum standard of competancy through knowledge of general principals, not specifics. In light of the vast amount of equipment and individual manufacturers involved in the construction of a modern vessel, any attempt to deal with specifics is considered unrealistic. An increase in sea time would do little to answer their concerns in that there is no way to guarantee an individual's exposure to all different items of equipment. I do not contend the license examination program is perfect, or nearly so, but we are constantly attempting to improve it. I can appreciate a vessel operator's desire to employ only those persons who are highly knowledgible in the operations of their vessels. In this regard, I consider the operator's responsibility to provide specific training to this end far outweighs that of the government through a license examination program.

Q. 14. During his testimony, Admiral Benkert of AIMS stated that the one year at-sea requirement was "primarily an effort of the Scandinavian countries and the countries of the European Economic Community". What are the present training requirements of deck officers in these countries?

A. See response to question eleven.

Q. 15. There are different types of bridge simulators. Which types, or in other words, how basic a simulator, would be adequate in training merchant marine officers for initial licensing?

A. The answer here relates to the effectiveness of the simulator and its ability to accurately reproduce a scenario in which basic ship handling skills can be taught and learned. Each simulator package could conceivably be totally different in terms of sophistication yet provide the same basic desired skills when effectively used. Once the minimum specifications have been established, a more definitive answer in terms of sophistication of hardware will be possible. See answer to question six for further

elaboration upon the relationship of simulation training to total training.

Q. 16. Can you provide the Subcommittee with a complete list of the 39 deficiences discovered on the BAY STATE? Could any of these deficiencies have jeopardized the safety of those people sailing on the BAY STATE?

A. The deficiencies noted during the inspection for certification of the BAY STATE in June and July 1980 at New Orleans, LA. and presented to the Massachusetts Maritime Academy are listed below. Some of the deficiencies noted could conceivably have jeopardized the safety of vessel personnel. In the judgment of the Officer in Charge, Marine Inspection, who issued the vessel's certificate of inspection, however, such a possibility was considered remote.

List of the 39 Outstanding Deficiencies for the BAY STATE

1. Make permanent repairs to ladder well 04 deck frame 90.
2. Make permanent repairs to wasted section of port air plenum top 03 deck frame 131.
3. Repair or renew damaged gaskets on exterior water tight doors main deck.
4. Provide adequate access to inspect the hull condition in way of all insulated refrigeration spaces.
5. Repair and reinforce damaged hand rails in way of life boat accommodation ladders.
6. Replace missing or damaged light guards and globes throughout vessel.
7. Resecure loose hand rails on exterior decks.
8. Inspect, stamp and stow an additional 566 adult life preservers.
9. Provide life preserver stowage accessible to on-watch personnel in the engine room (12 ea.), pilothouse (12 ea.), bow lookout (1 ea.), and fantail (1 ea.).
10. Repair broken welds on boat davit arm locking device, davits 3 and 4.
11. Repair broken dogging cars on watertight port light tween deck port side frame 80.
12. Relamp/repair emergency lighting and exit lights throughout vessel.
13. Regasket and replace missing and/or broken dogs on 1-10 davit electrical junction boxes.

14. Conduct installation test to 1, 2 and 9 boat davits prior to use.

15. Conduct fire and boat drill. Testing and inspection to be conducted to the satisfaction of the cognizant OCMI.

16. Post maneuvering information to the satisfaction of the cognizant OCMI.

17. Repair 1 MC, public address system to the satisfaction of the cognizant OCMI.

18. Provide Oil Transfer Procedures in accordance with 33 CFR 155.

19. Install sheet lead lining or other acceptable material in all shelving for storage batteries in accordance with 46 CFR 111.15.

20. Make permanent repairs and prove operation of bilge eductor for chain locker.

21. Install hand rail and coupling guard on main shaft near stern tube.

22. Install and demonstrate an approved charging system for radio and smoke detecting emergency batteries.

23. Install and prove operation of remote shut-off for fuel transfer pump.

24. Hydrostatically test all oil transfer hose and piping in accordance with 33 CFR 156.

25. Make permanent repairs and prove operation of priming pump for bilge and ballast pump and electric submersible bilge pump.

26. Make permanent repairs to steam supply stop valve at external desuperheater.

27. Install deck bilge slop discharge connection and prove operation of remote shutoffs for each slop oil discharge pump in accordance with 33 CFR 155.

28. Install an approved Marine Sanitation Device. Vessel is authorized to discharge minimal quantities of raw sewage into Buzzards Bay, Boston Harbor and those areas which vessel must transit when arriving at/departing these two areas for the period 15 June 1980 to 31 August 1980, in accordance with COMDT (G-WEP) letter of 16 April 1980. Installation shall be to the satisfaction of the cognizant OCMI.

29. Comply with OCMI, New Orleans letter of 16 June 1980 concerning thermal stress analysis and main steam stop valve approval, starboard boiler, limiting main steam temperature to 800 degrees F.

30. Remove oil and water separator or make accessible for inspection in accordance with 46 CFR 61.10 prior to May 1982.

31. Make permanent repairs and prove operation of all Class III doors or remove all power controls from the same.

32. Renew hot water heater.

33. Make permanent repairs to leak in starboard sea chest steam out supply line in lower engine room.

34. Make permanent repairs to leak in chill water line in auxiliary generator room.

35. Make permanent repairs to steam supply stop valve for starboard forced draft fan turbine and test overspeed shutdown on turbine prior to placing starboard forced draft fan turbine in operation.

36. Make permanent repairs to the feed make-up line forward of the starboard boiler.

37. Unlag, inspect, repair, and relag as necessary, lowest boiler uptake expansion joints on both boilers.

38. Make operational or remove fuel oil settling tank high level alarms and remote reading gauge.

39. Service or renew as necessary salinity indicating systems.

Requirements 5 thru 12, 15 thru 24, 27, 33 thru 36, and 39 are to be completed prior to departing Buzzards Bay, Massachusetts for the 1980 summer cruise.

Requirements 1 thru 4, 37 and 38 are to be completed prior to departing Buzzards Bay, Massachusetts for the 1981 summer cruise.

Requirements 13, 25 and 26 are to be completed prior to 1 October 1980.

Requirements 31 and 32 are to be completed prior to May 1982.

Q. 17. You testified that after she was renovated, the BAY STATE met the criteria necessary to obtain a certificate of inspection from the Coast Guard. In light of the problems she later experienced, and in light of the fact that 39 deficiencies were found by the Coast Guard, could it be that the requirements for receiving such a certificate are not stringent enough?

A. The regulations contained in 46 CFR 166-168 set the minimum safety standards for certification of nautical school ships. It is the Coast Guard's view that the application of these regulations does provide for an acceptable level of safety for such vessels as the BAY STATE.

Determinations concerning deadline dates for correction of deficiencies noted during a vessel inspection apply equally to all classes of vessels subject to inspection and are based upon the following considerations:

(a) the seriousness of the deficiency in relation to the overall safety of the vessel;
(b) availability of parts or equipment,
(c) vessel schedule; and,
(d) where feasible and consistent with safety considerations, the desires of the vessel operators.

Serious deficiencies require immediate correction. For less serious deficiencies, a certain amount of flexibility in prescribing correction deadlines is exercised as indicated in my response to question 16.

Q. 18. Who has the ultimate responsibility for insuring the safety of a vessel like the BAY STATE that has undergone extensive renovation? Was the responsibility met in the case of the BAY STATE?

A. From a strictly legal viewpoint, the ultimate responsibility for insuring the safety of a vessel resides with the owner/operator. The fact the vessel has been granted a certificate of inspection in no manner relieves the owner/operator of this responsibility (The Lyndhurst, 149F 900 (DC ED NY 1906)).

In this particular case, we believe no culpable negligence exists on the part of any Federal or State Agency. Serious deficiencies were corrected prior to departure from New Orleans, and less serious items deferred as we have indicated in our responses to questions 16 and 17. The unfortunate events on the BAY STATE appear to be more of a series of fortuitous events rather than a purposeful ignoring of known deficiencies.

STATE OF CALIFORNIA Edmund G. Brown Jr., Governor

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28 October 1980

The Honorable Les AuCoin
Chairman
Ad Hoc Select Subcommittee on
Maritime Education and Training
721 House Annex 1
Washington, DC 20515

Dear Congressman AuCoin:

It was a pleasure to respond to questions in your letter of October 8th regarding maritime education and training. For your convenience I have repeated your questions prior to adding my response.

1. During his testimony before the Subcommittee, Rear Admiral Rodgers claimed that we should be "studying new training ships in spite of the fact that simulators are becoming increasingly important." Do you agree that state academies should devote more time and resources to training vessels? Would small craft be adequate for a portion of the training?

   I agree with Admiral Rodgers that Maritime Administration should continue their study of new training ships. For the next ten years training ships will continue to carry the major training role, particularly if we must expand our sea time to meet IMCO requirements. There is no guarantee that the present training vessels will not have to be replaced during this period.

   Unlike the other more modern state academy training ships with passenger accommodations for cadets, the California Training Ship GOLDEN BEAR, built in 1940 and used as an attack transport in World War II, is a cargo vessel. Students live in cargo holds in troop style accommodations. It is imperative that these World War II cargo hold-type living accommodations on the GOLDEN BEAR be improved substantially as soon as possible. This correction can be accomplished at a cost of about $4 million and it is strongly recommended that the Congress provide funds specifically for this purpose. This amount is in addition to the normal annual cost of maintenance and repair. If this upgrade is accomplished, the Training Ship GOLDEN BEAR will provide an adequate and effective training ship for the next ten years. By maintaining the modern electronic equipment such as the collision avoidance system, radar and navigation, communications systems and engineering equipment as is now provided on the T.S. GOLDEN BEAR, you will have a training ship very adequate for sea training and cost effective considering the high cost of developing and building a new training ship. A new training ship, although desirable, is not essential. In addition, simulator training is becoming increasingly important and in most instances is much more effective and more efficient than shipboard training.

   My previous testimony before this committee discussed the simulator aspects of training. In my view, utilization of simulator training in the merchant marine is about ten years behind the times. We have the technical capability and sophistication in computers and simulation to develop now the various

simulators needed for shipboard training. With the rapid advances being made in computer technology, I firmly believe that in ten to fifteen years most shipboard training can be conducted on simulators. All shipboard simulators can be integrated into one complete unit ship simulator. At that time, training schoolships should be maintained at the academy campus pier as a live laboratory only. In addition, the schoolship also could serve as one of the ready reserve merchant ships to be used when needed by the government. The at-sea training phase of cadet training could be reduced to three or four months only and served on board a commercial ship primarily in order to expose the cadet to the merchant marine environment. A schoolship training cruise would no longer be needed.

I am convinced that required simulator training will decrease significantly shipboard accidents and casualties at sea. With the technology we have today in simulator training, I believe that we are negligent in continuing to tolerate the high rate of casualties at sea; there is no excuse for this situation. Seventy to eighty percent of accidents at sea are due to personnel errors. It should be obvious that the quality of training must be improved and that a better method of training must be initiated. Think of the savings in costs, resources and lives that will result vis-a-vis the relatively meager costs of providing simulators for training at state maritime academies and requiring training on simulators and certification for every aspect of ship operation. One disaster prevented would provide many simulators. The simulator is the most effective, efficient and cost effective training available today.

Would small craft be adequate for a portion of the training?

Initial training and experience aboard smaller craft and tugboats is the most efficient and effective way to develop practical seamanship skills and shipboard ability. Vessels of thirty to ninety feet in length are excellent for the training of young officers. This is an area where actual experience rather than simulated training is extremely important. With smaller vessels, skills and techniques can be developed over a period of time by repeating various maneuvers, while building up in vessel size. This is an area in which most merchant marine officers get little experience. Shiphandling can most effectively be learned on tugboats initially. I recommend that day-for-day "equivalency" be awarded for up to two months training aboard small craft between 100 and 1,000 tons displacement.

2. Should training vessels engage in commercial missions as part of the activity during a training cruise? What do you think of fostering such commercial activity as part of the cruise?

The California Maritime Academy frequently has carried small amounts of commercial cargo during a training cruise. Usually this cargo has been supplies and equipment for relief of a stricken area or charitable donations of equipment for international goodwill. I see no technical objections to carrying commercial cargo for hire. However, we could anticipate some objections from commercial carriers and maritime unions. On a practical basis, however, the cargo carrying capacity of training ships is too small to have any competitive commercial significance. The training value to be

gained from carrying commercial cargo would outweigh the economic inefficiency of carrying very small lots of commercial cargo.

I also would recommend the use of our training ships as excellent mobile platforms for a trade fair or display of U.S. products in conjunction with the training cruise. Such an operation would be entirely compatible with a training cruise and at the same time it would provide funds to offset ship's operating costs such as fuel oil. It would be an efficient and practical operation.

3. Should different types of bridge simulators be installed at the state academies? In this event, would the academies consider an exchange program for their cadets to experience a variety of simulator techniques?

There would be no particular advantage in establishing different types of bridge simulators. Changes in the simulation program can produce the change in response associated with hull configuration, engine power, propeller pitch, displacement and speed. The physical configuration of the bridge is not considered to be a significant variable. An exchange program offers an alternative approach to individual on-site construction of simulator facilities. However, student exchange would be a very costly undertaking. Transportation costs, per diem costs and schedule adjustments would have to be weighed against the capital outlay savings.

4. Should training on all three types of simulators -- bridge, radar and tanker -- be required?

Absolutely; no hands-on training facility can match the intensity or the quality of simulator training. Also, simulator examinations for license incorporating common shipboard emergencies should be required by the U.S. Coast Guard as a complement to the written examinations.

Computer simulation can create any condition of constricted passage and heavy traffic anywhere in the world and any condition of wind, wave, tide, storm or any shipboard situation at sea. Simulators will speed up the training process. Emergencies can be simulated which will seldom be encountered in a lifetime at sea. Case studies of past accidents and disasters can be recreated and studied on a simulator. A simulator can create unsafe conditions that could not be duplicated in actual shipboard operation. Every conceivable accident or possible failure can be accomplished more safely, more efficiently and in a shorter time on a simulator than on a training ship. Simulation training turns out better officers because they learn by their mistakes on the simulator. Simulators are valuable for training new officers and they are more equally useful for training veteran officers on new equipment. Furthermore, simulators provide months of experience in a matter of hours.

Many of our midshipmen seek employment in liquid carriers. For this reason, as a part of our training program to reduce the cause of environmental pollution, we require all Deck midshipmen to take our Tanker Simulator course. Furthermore, fuel transfer operations are common to the operation of every type of vessel.

Radar simulator training is also required of all of our Deck midshipmen, basically for qualification as "Radar Observer" but also for piloting, radar navigation, limited shiphandling, and rules of the road training.

A ship or bridge simulator is a necessary addition to our training effort, and a course structured around such a simulator would be required for all Deck midshipmen. Familiarization training would be provided for Engineering midshipmen.

5. Should any part of the one-year requirement be spent actually at sea, or should simulator time, training vessels as dockside laboratories, and smaller vessels be the way of fulfilling this requirement in the future?

For the present we must hold to the minimum requirement of six months sea time, since we do not have adequate bridge and engineroom training simulators operational at this academy. However, I estimate that within the next ten to fifteen years, highly sophisticated simulators will be taking over the bulk of shipboard training. This simulator capability available for training will have reduced considerably the need for the amount of time now spent on shipboard training. Ten to fifteen years from now I would estimate that for cadets at state maritime academies, only three to four months aboard a commercial ship at the most would be sufficient to supplement the time spent training on the simulators. The training ship program at sea, as utilized today by state academies, then could be eliminated. Our present training ships could be maintained on campus as laboratories at the pier which could be activated in an emergency for use in the Ready Reserve Merchant Ship program. In ten to fifteen years the operation of a training schoolship will have become excessively more expensive in manpower, energy, resources and time. Prolonged training at sea will become increasingly more limited in scope due to the potential danger inherent in a training operation conducted in high density traffic.

Six months of time on a training ship should be well integrated into a progressive training program utilizing a combination of simulators, small craft, and dockside ship labs to properly prepare the student to obtain maximum benefits from his six months aboard the training ship.

An organized progressive training program of three successive underway shipboard training periods, integrated with preparatory training on various types of operational simulators, small vessels and dockside laboratories aboard the ship, makes the at-sea periods far more worthwhile than would ever be achieved without this type of approach. It is essential that the training ship experience be conducted under a controlled instructional environment to progress logically on skill levels developed in the pre-training period. Such a program develops a far better trained officer than using the same amount of time and effort (one year) on board ship only. It is essential that a combination of simulator time, shipboard dockside training time, and small craft instructional time be considered equivalent to some portion of the at-sea time.

Instructional time aboard ship while alongside the dock is necessary, to demonstrate while in a non-operational mode, the operation of many types of equipment not essential to the life of the ship. This would include such items as cargo gear, steering gear, gyro compass, lifeboat maintenance and many others. This training should be counted for up to 90 days of at-sea training time with each eight hours of actual instruction/laboratory aboard equivalent to one day of sea time.

Small vessel training is one of the backbones of instruction in seamanship, shiphandling, piloting and lineshandling. By using vessels of increasing size from 26' to 65', the student develops skills on his own, is able to make mistakes without serious consequences and receives far more opportunity to handle vessels. This type of vessel can perform a maneuver in much less time and at far reduced cost. The student becomes better prepared through this type of program to actually handle the large training ship through an entire one- to two-hour maneuver during his senior cruise. This is truly the zenith of his practical instructional career at CMA.

Time spent in small craft practical operation and instruction should count as up to sixty days of equivalent time to sea training. Each six hours of actual time under instruction or small craft operation should count as one day of equivalent sea time.

Simulator training has created a revolution in training for the seagoing professions. It allows for time consuming exercises aboard ship to be condensed into shorter time periods. Simulators permit the instructor to set up certain situations to emphasize particular points. Simulators make it possible to let students make mistakes to prove a point without serious consequences to life or limb or the environment.

Time on shiphandling simulators, as well as radar simulators, cargo handling simulators, and engineering simulators should be counted as equivalent time to sea training. Up to 60 days of sea time should be allowed with three hours of actual simulator time to count as one day of equivalent sea time.

At the present time the California Maritime Academy follows a program similar to the format described above. This program far exceeds the proposed one year sea training requirement. Following is a brief description of our program:

Course No. and Title	Description	Actual Time
D-115 Shipboard Lab First Semester CMA (Dockside)	A course combining instruction in the practical use of cordage, knotting, splicing, whipping, reeving tackles and rigging stages and boatswains chairs with day-to-day practical operation and maintenance of an operating vessel. Chipping, painting and assigned work both on the interior and exterior of the training ship are included.	90 hrs.

Course No. and Title	Description	Actual Time
D-102 Small Vessel Operation Second Semester CMA (Small Craft)	An operational course aboard the Academy's 65-ft. steel T-boats designed to give the students practical experience in anchoring, line handling, seamanship and piloting.	45 hrs.
PE-101 Boathandling (Small Craft)	Operational instruction in rowing, handling boats under oars and sail, launching and recovery of lifeboats, lifeboat nomenclature and equipment. This course prepares the student for the U.S. Coast Guard Lifeboatmen's Certificate.	90 hrs.
D-116 Shipboard Lab Third Semester CMA (Dockside)	A course consisting of practical instruction in both the basic practical and theoretical aspects of cargo handling. Models are used to show stresses on the various parts of conventional cargo gear. Practical instruction in wire splicing and canvas work is included. All instruction is put to practical use loading cargo and maintaining cargo gear on the training ship.	90 hrs.
D-501 Sea Training Fifth Semester CMA	During the first sea training semester the students are familiarized with shipboard routine. They receive one unit for watch standing in the capacity of ordinary and able seaman where they act as helmsman, lookout and standby, and observe watch routine. The students receive two units of ship's maintenance and seamanship at which time they receive a blend of lecture and actual practical applications. In addition, each student receives one-half of a unit for an introductory course in Communication and Rules of the Road.	12 wks.
D-215 Seamanship Lab Sixth Semester CMA (Dockside)	Part 1: Practical instruction on board ship covering the operation and maintenance of all specialized deck machinery including anchor windlass, winches, capstans and cargo gear.	45 hrs.

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Course No. and Title	Description	Actual Time
(Small Craft)	Part 2: Practical instruction in the operation of small craft conducted aboard the Academy's 26-ft, 36-ft. and 40-ft. launches.	45 hrs.
D-226 Ship's Operations Seventh Semester CMA (Dockside)	Practical work on maintenance and overhaul of shipboard safety gear including lifeboats, liferafts, emergency squad lockers, fire-fighting systems and damage control equipment.	45 hrs.
D-502 Sea Training Eighth Semester CMA	During the second sea training period the student will receive one unit for operation of the vessel in the capacity of Junior Watch Officer. Two units of marine technical skills such as loading stores, cargo operation, maintenance, supervisory skills, safety, lifesaving and firefighting. One-half of a unit will be given for Communication classes in light and flag hoists and one-half of a unit in Rules of the Road classes and practical application. During this sea training period the student will spend about one-third of his time under supervision of the ship's navigator in practical navigation exercises.	12 wks.
D-315 Applied Seamanship (Shiphandling) Ninth Semester CMA (Small Craft)	Practical experience in shiphandling with vessels sufficiently large to duplicate shiphandling problems encountered with much larger vessels. Participants are exercised in "soft" landings, anchoring techniques, man-overboard procedures, mooring techniques and linehandling, towing, emergency drills and collision avoidance.	45 hrs.
D-325 Marine Supervisory Lab Ninth Semester CMA (Dockside)	Basic introduction into the skills of first level management by means of supervisor work groups aboard the training ship with the objective of using skills learned to accomplish assigned tasks.	45 hrs.

17.

Course No. and Title	Description	Actual Time
D-326 Marine Management Lab Tenth Semester CMA (Dockside)	The management of ship stores crew and personnel is stressed in this practically oriented course. The paper work and government forms necessary for ordering supplies, inventory lists, personnel management forms, and inspection forms are used. Project organization is stressed by allowing the senior midshipman to organize and administer work aboard the ship during lab periods.	45 hrs.
D-305 Radar Tenth Semester CMA (Simulator)	This course evolves around the Academy's Radar Simulator. Instructor stresses operation of radar, collision avoidance, coastal piloting and navigation and Rules of the Road.	45 hrs.
D-314 Tanker Loading Simulator Tenth Semester CMA (Simulator)	Each student receives practical instruction on the Academy's computerized Tanker Cargo Loading Simulator.	45 hrs.
D-503 Sea Training Eleventh Semester	During the third training cruise the student receives one unit for vessel operation while acting as Senior Watch Officer, at which time he has the full responsibility for the navigation, collision avoidance, maneuvering and routine. He receives two units for Navigation Lab during which time he determines 0800, 1200 and 2000 positions and does a full day's navigation work. In addition, he receives one-half of a unit in Communication (radio, light and flag) and another half of a unit in Meteorology lab. Each student is given a responsibility normally assigned a ship's officer. His job is to develop a plan to do the job, justify the personnel required, organize them into a work force and supervise the accomplishment of the task.	12 wks.

SUMMARY OF SEA TIME/EQUIVALENT CMA

Type of Training	Actual Time	Equivalent Time at Sea
Dockside	360 hrs.	45 days
Small Craft	180 hrs.	30 days
Simulator (Radar and Tanker Loading)	90 hrs.	30 days
Sea (training ship)	56 wks. (8 months)	252 days
TOTAL		357 days

It is my belief that the above-described program not only meets the letter of the law in the one-year sea time statement, but provides a much better training package to provide high quality merchant marine officers.

In addition, ninety hours on a bridge shiphandling simulator, equated at two hours of bridge simulator time for one day at sea, becomes equivalent to 45 days at sea. Added to the above sum of 357 days, the total time at sea then will exceed the one-year IMCO sea requirement.

I hope this answer to your question makes the California Maritime Academy's position on this matter very clear.

6. How long has California Maritime Academy used simulators? Have your positive results led you to increase the amount of curricular time devoted to simulator training.

Our Tanker Simulator became operational in January of 1979 in the initial mode. The improved mode, incorporating simultaneous trim and stress data, was available in February of 1980. Our Radar Simulator became operational in April of 1980. Funding arrangements virtually are complete, and we expect to have a Marine Diesel Engineroom Simulator operational on our campus within one year.

An impressive classroom curriculum has been built around both simulators so that maximum results, compatible with the equipment capabilities, are being achieved. Each of these simulators is being updated as funds permit. For instance, the Tanker Simulator has incorporated ship trim and stress capabilities since initial installation and will soon be modified to include inert gas features. The Radar Simulator will soon be modified to include automatic collision avoidance features.

In less than two years the amount of student time spent on simulators has increased from about 24 hours to 90 hours. Our Radar Simulation Laboratory provides practical training in the basic theory of radar and the adjustment and operation of the radar set. Our primary course teaches radar plotting for basic rules of the road, collision avoidance and navigation to enable the student to qualify for the Coast Guard certification of "Radar Observer."

15.

However, we use the simulator for a variety of other new training roles:

Third Class (Sophomore) - Use the coastline generator of the radar simulator for six hours practical work in conjunction with classroom instruction in navigation piloting.

Second Class (Junior) - In the fall, continue training in radar navigation for six hours; nine hours of instruction in classroom and simulator on basic principles of deriving information from radar presentations and relative motion and determining courses of action to avoid collisions. In the spring, we provide six hours of training on rapid radar plotting and basic problems of collision avoidance.

First Class (Senior) - In the fall our midshipmen take a minimum of 45 hours to qualify for Radar Certification including theory, operation of equipment, collision avoidance, radar navigation, and operation and principles of Electronic Relative Motion Analyzers. During the annual training cruise, the First and Second Class midshipmen undergo intensive training in all phases of radar navigation and collision avoidance, since the training ship deliberately is taken into high-density shipping lanes whenever possible.

Our Tanker Simulator Laboratory simulates a 70,000 DWT tanker. All First Class (Senior) Deck midshipmen are required to complete a course in tanker operations. As part of this course, a laboratory period is conducted on a trimester basis, and each midshipman spends a minimum of 18 hours acquiring skills in loading, discharging and emergency procedures. Real time, stress and trim calculation simulation is provided and anti-pollution measures are stressed. The simulator provides repetitive and realistic emergency situations in all areas of liquid cargo operations. By the time the midshipman has completed the course, he has had to cope with a myriad of crisis situations. Eventually we hope to incorporate a crude oil washing system into the simulator. In one week, the veteran tanker students learn more about oil transfer operations than they did in a year aboard an operational tanker.

Completion of our Marine Diesel Engineroom Simulator in about one year will add at least another 60 hours of simulator time for our Engineering students.

Again, let me thank you for allowing me the opportunity to offer my views on these vital areas of maritime training. Please write or call anytime that I can be on any assistance.

Sincerely,

J. P. RIZZA
Rear Admiral, USMS
President

JPR:prg

cc: Mr. Arthur W. Friedberg
Maritime Administration

152

GREAT LAKES MARITIME ACADEMY
Northwestern Michigan College
Traverse City, Michigan 49684
616/ 946-5650

November 26, 1980

The Honorable Les AuCoin
Chairman
Ad Hoc Select Subcommittee on Maritime
Education and Training
721 House Annex 1
Washinton, D.C. 20515

Dear Congressman AuCoin:

Thank you for an opportunity to reply, in writing, to questions which were not asked at the September 9, 1980, oversight hearings due to time restraints.

1. During his testimony before the Subcommitte, Rear Admiral Rodgers claimed that we should be "studying new training ships in spite of the fact that simulators are becoming increasingly important." Do you agree that state academies should devote more time and resources to training vessels? Would small craft be adequate for a portion of the training?

As you know, this Academy does not have a training ship. Our mission and goal is to train the best qualified ship officers possible for the Great Lakes. Central to this goal is our belief in hands-on experience aboard commercial vessels. This is "real world" experience. Further, it provides experience aboard the very same vessels to which cadets may be assigned for their first jobs. Commerical placement recognizes the need for the cadets to be accountable: their reputation starts to be formed from the first day aboard as a cadet.

The advent and sophistication of simulators in maritime training provides opportunities to accomplish certain types of training that are normally not possible aboard operating commercial vessels. Such training includes collision avoidance, engineering casualty control, firefighting, and the handling of other emergency situations. It is my view that appropriate simulator training should be substituted for a portion of the required nine months sea time for Great Lakes Maritime Academy cadets.

We consider our small craft exercises in ship handling, towing, navigation and collision avoidance, and dock bumping a key ingredient in our deck officer training program. While we have never asked for a reduction in sea time, the importance of this activity certainly merits inclusion in any consideration of an equitable reduction.

2. Should training vessels engage in commercial missions as part of the activity during a training cruise? What do you think of fostering such commercial activity as part of the cruise?

Due to our placement of cadets aboard commerical vessels, it is not appropriate for us to answer this question.

3. Should different types of bridge simulators be installed at the state academies? In this event, would the academies consider an exchange program for their cadets to experience a variety of simulator techniques?

I don't see any advantage to different simulators at different academies. I am sure one can be selected that will allow a majority of the desired simulations. Also, shipping cadets around to other academies creates scheduling, logistical, and financial problems.

4. Should training on all three types of simulators -- bridge, radar, and tanker -- be required?

I think minimum standards of competency should be more accurately identified. After that, the tools needed to accomplish this level of competency can be more easily assessed.

5. Should any part of the one-year requirement be spent actually at sea, or should simulator time, training vessels as dockside laboratories, and smaller vessels be the way of fulfilling this requirement in the future?

I don't believe we should leave a stone unturned in training more competent and safety-conscious ship officers. The returns in reduced accidents and less environmental damage far exceed the cost. Having said this, the methods mentioned (small boats,

simulators, labs, etc) are all valid vehicles for accomplishing an ever higher degree of training.

Since American ship officers are probably among the best trained in the world, I believe our interest in higher levels of skill should be totally divorced from suggested standards that require a full year of sea time. I don't believe that quantity necessarily relates directly to quality. Programs presently offered by America's Maritime Academies are the equal of standards set forth by IMCO and should require no additional time at sea.

Sincerely,

George B. Rector
RADM, USMS
Director

GR:a:aec

cc: Mr. Eric Bernhardt, MarAd
Adm. Paul Trimble, Lake Carriers'
State Maritime Academies
Dr. William Yankee, President NMC

MAINE MARITIME ACADEMY
CASTINE, MAINE 04421

24 October 1980

The Honorable Les AuCoin, Chairman
Ad Hoc Select Subcommittee on
Maritime Education and Training
721 House Annex 1
Washington, D. C. 20515

Dear Congressman AuCoin:

I was pleased to receive your letter of October 8 and welcome the opportunity to respond to the questions posed therein:

1. Should training vessels engage in commercial missions as part of the activity during a training cruise? What do you think of fostering such commercial activity as part of the cruise?

   Maine Maritime Academy wants to go on record as being strongly in favor of conducting commercial activities aboard the training ship during cruises. The amount of cargo and/or number of passengers (educational program for students other than maritime cadets) carried would have a negligible impact on private commercial activities whereas the benefits to the academies in training and financial support could be significant. A serious weakness in our program today is the lack of opportunity for students to handle cargo or to become acquainted through practical experience with all aspects of a total cargo transportation system. From a national point of view, it would appear that the use of training ships for trade promotion activities aboard in foreign ports could help to generate cargoes for U. S. flag ships and give students aboard an appreciation for the marketing of products that eventually leads to cargoes.

   The present training ships have very limited potential for commercial activities, but authority to engage in this activity, even in a limited way, together with the encouragement and administrative support of the Commerce Department would provide sufficient experience to possibly influence the design of future training ships.

2. Should different types of bridge simulators be installed at the state academies? In this event, would the academies consider an exchange program for their cadets to experience a variety of simulator techniques?

Bridge simulators can be a very effective training aid, but I question the need for very expensive and sophisticated bridge simulators in the initial license program. In my opinion the so-called full mission bridge simulator should become an instrument for certification in conjunction with the chief mate and master's license and a small vessel designed to perform as a simulator of larger vessels would be much more effective for training prospective third mates. Maine Maritime Academy has completed the conceptual design phase for such a vessel but has not been able to proceed further for the lack of funds.

There is a wide consensus of opinion amongst those individuals responsible for maritime training that the additional six month sea time for state academy deck cadets required by the IMCO agreement cannot be justified. Therefore, even the equivalency measure being considered to satisfy the document rather than the need should be studied very carefully as to their impact in terms of time and costs. Furthermore, we need to recognize that the technology in simulator development will, undoubtedly, change rapidly during the next decade so it would appear wise to proceed slowly and work toward a rather simple modertately priced simulator for the cadet programs and put immediate emphasis on a small vessel program that can continue to be an effective training device for several decades. For the price of one bridge simulator each academy could have a small training vessel.

I cannot give a good, direct answer to the questions posed because I am not aware that there are sufficient differences in the presently available bridge simulators to justify the cost of having students travel between the different academies. More information is needed on the capabilities of the proposed simulators.

3. When a cadet sails on a merchant vessel, who oversees the completion of his or her academic project during the time at sea? Does the Coast Guard in cooperation with the state academies set regulations for this?

15.

Beginning in 1967, our Academy initiated with MARAD/ U. S. Coast Guard officials a cadet training program permitting us to assign our cadets to training billets on commercial ships in substitution for one of three required training cruises on our training ship.

The U. S. Coast Guard conditioned its approval on the completion of a satisfactory sea project. If the condition is met, the U. S. Coast Guard will accept not exceeding sixty (60) days of such training to count toward the present 180 day original license requirement. The sea project is prepared by our training division officers, one for deck cadets and one for engine cadets. The sea projects are graded by these officers.

While on board one or more of the officers will supervise the cadet training program which is best explained by the enclosed reporting-on-board letters addressed to the master (deck cadet) and chief engineer (engine cadet).

Additionally, our cadets are required to submit:

1. A satisfactory cadet shipping report;
2. Satisfactory ship's officer's evaluation report;
3. Satisfactory evidence of sea time

in order to receive approval of the sea time and four hours of course credit.

To the best of my knowledge no other state academy has perfected this type of training to the professional level attained at Maine Maritime Academy. One has a limited program whereas other state academies have experimented with observer as distinguished from training programs which often do not involve sea projects or U. S. Coast Guard approval. The emphasis in such cases is obtaining some practical experience on an observer basis.

I must also emphasize that the support we receive from the shipping organizations is voluntary support which gives recognition to the high standards to which we hold our cadets. Unfortunately, there are not a sufficient number of training billets to accommodate cadets from all of the state academies. To require this by law a regulation would create an administrative nightmare considering the present size of our U. S. Merchant Marine and the lack of cadet accommodations. As you know, the subsidized carriers are required to provide cadet training billets for the U. S. Merchant Marine Academy.

It is difficult at best to cover all of the above subjects adequately, but it is my hope you will find the information useful. Please let me know if I can be of any further assistance.

Sincerely,

E. A. Rodgers

E. A. RODGERS
RADM, USMS
SUPERINTENDENT

Enclosures

[Enclosed report referred to in this letter has been retained in the subcommittee files.]

The Commonwealth of Massachusetts

Massachusetts Maritime Academy

P. O. BOX D, BUZZARDS BAY, MASSACHUSETTS 02532 / DIVISION OF STATE COLLEGES

October 23, 1980

The Honorable Les AuCoin
Chairman, Ad Hoc Select Subcommittee
on Maritime Education and Training
Congress of the United States
Washington, D. C. 20515

Dear Congressman AuCoin:

Thank you for your letter of October 8th and the opportunity to respond in further detail to some of the statements and questions presented at the September 9 oversight hearing. This reply is ordered to correspond to the specific questions posed in your recent letter:

1. I agree with Rear Admiral Rogers that, because we both recognize that the training ship lies at the heart of an efficient maritime training program, realistic replacement hulls should be planned for the future. Simulator training can only serve to complement the training time at sea and give the opportunity to investigate hazardous navigational and maneuvering situations that hopefully will never be encountered during their training vessel experience. It is becoming increasingly obvious, as the difficulties in operating the present class of training vessel multiply with age, that a viable replacement source for the existing fleet of training vessels be recognized.

It would be extremely difficult for this Academy to devote any more time or resources to training vessels. Our state budget is just not equipped to respond to the extremely high maintenance, operational and other peripheral costs involved with running a large training vessel. Furthermore the demands of the academic program, and our accrediting authorities, further restrict the possibilities for increased seatime during the four year baccalaureate degree period.

Small craft can provide an acceptable means of complementing the large training vessel, but even these vessels are extremely expensive to operate in terms of fuel and officer and crew salaries.

2. This question has been discussed at some length. It is the unanimous opinion of experienced faculty and staff that the logistical difficulties imposed by operating training vessels on a semi-commercial basis would cause insurmountable problems. Great difficulty has been experienced in operating the last three training cruises at this

Academywithin the physical parameters already existing. To present a further range of operational limitations would be impractical.

3. The distance between the Academies and the high cost of travel for the number of students involved dictates that a "Full Function Bridge Simulator" be installed at each of the Academies. If the correct type of simulator is chosen, there is no reason for an interchange of students between Academies, (see 5).

4. Each cadet sailing on a merchant vessel is required to complete a term paper and voyage report to the satisfaction of an assigned faculty advisor. Reports on the cadet's performance and general conduct are solicited from the Master and deck or engineering officer responsible for the cadet's daily shipboard work. The Coast Guard does not monitor these projects.

5. The United Kingdom's simulators are distributed as follows:

(a) Radar simulator at all maritime colleges, approx. 12.

(b) Nocturnal bridge simulators at four colleges.

(c) Full function bridge simulator at one college.

6. The United Kingdom's simulators are paid for by the local educational authority from funds provided primarily by the government of the United Kingdom. The industry participates by paying approx. $1200/student/week for each officer that is sent to a college for simulator training.

We at the Academy believe that it is of paramount importance that both the incoming junior officers and serving officers of the merchant marine are afforded the high technology training facilities provided by other leading maritime nations.

I thank you sincerely for the interest demonstrated by yourself and members of the Select Subcommittee on Maritime Education and Training in providing effective educational and training programs for the merchant seaman of the United States,

William R. Hendy Jr.

Commodore William R. Hendy, Jr.
Acting President, M.M.A.

WRH:ik

STATE UNIVERSITY OF NEW YORK
MARITIME COLLEGE
FORT SCHUYLER, BRONX, N. Y. 10465
TELEPHONE (212) 892-3000

REAR ADMIRAL SHELDON H. KINNEY, U.S.M.S.
PRESIDENT

31 October 1980

Honorable Les AuCoin
Chairman
Ad Hoc Select Subcommittee on
Maritime Education and Training
Congress of the United States
House of Representatives
Washington, D.C. 20515

Dear Congressman AuCoin:

In your letter of 10 October, you asked several questions regarding practical training for the initial licensing of merchant marine officers. We appreciate the opportunity to present our views.

1. a) Should the state academies devote more time and resources to training vessels?

It is extremely unlikely that state appropriations will increase in amounts sufficient to expand the length of the annual training cruise, or to make improvements to a U.S. Public Vessel at New York State expense. Nor can New York afford the expense of the federal responsibility for repair. Six months' supervised training ship time is adequate when the dedicated sea period is embedded in a comprehensive training/education program (including all kinds of instruction and small craft experience). Let's get away from "apple time equals X-% part orange time."

b) Would small craft be adequate "for a portion of sea time?"

While small craft drill would enhance training, it should not be equated to a portion of (big ship) sea time. They are different. We are convinced that the critical aspect of sea time training is its integration into a coherent program that is planned, supervised, and tested by professionally experienced seaman/engineer educators. The overall program includes a variety of mutually complementary components, including small craft experience. We should avoid making strained analogies comparing experiences that are not comparable.

2. Should training vessels engage in commercial missions?

No. The commercial mission would dictate time, schedule, and route, and dilute training ship personnel with non-training team (commercial) riders.

3. Should different types of simulators be installed and exchange programs for cadets be considered?

The ideal bridge operations trainer would be CAORF-compatible. The Research CAORF could develop scenarios that would be fed to trainers (CAORF-compatibles). Trainers at the State Academies could be fed these "master scenarios" as part of a professionally-developed syllabus. This would provide training program quality control. The common trainers at the State Schools could develop other special-interest compatible scenarios and exchange them. The answer is no, we do not believe different types of bridge simulators should be installed.

No, we would not like to consider exchange programs for Cadets, with attendant travel expenses, time slippage, etc. (Except, of course, minor visits Maritime Cadets can make to Kings Point, just across the river.)

New emphasis on simulators must not permit the training ships to be neglected. The condition of the ships requires a major sustained commitment for their maintenance and repair. The training ships are our primary training aids.

Mr. AuCoin, the Maritime College is greatly indebted to you for the energetic manner and high degree of competence with which you have undertaken the extensive investigation into education and training for our merchant marine and the results that you and your Committee have produced. We at Fort Schuyler are grateful that the channels of communication between the State Academies and the Committee have been so open. In the nine years that I have been president, there has never been the opportunity for the State Schools to be heard, that you have on your "watch" fostered. We, and the nation's merchant marine, are in your debt.

Sincerely,

Shelby Kinney

THE AMERICAN WATERWAYS OPERATORS, INC.
WASHINGTON EXECUTIVE OFFICES
1600 WILSON BOULEVARD • SUITE 1101 • ARLINGTON, VIRGINIA 22209
ANTHONY J. KUCERA, President
TELEPHONE (703) 841-9300

October 15, 1980

Honorable Les AuCoin
Chairman
Ad Hoc Select Subcommittee on
Maritime Education and Training
U.S. House of Representatives
Washington, D. C. 20515

Dear Mr. Chairman:

In response to your letter of October 10, 1980 requesting information on the cooperative training program between the Coast Guard and the towing industry, the enclosed two reports of Coast Guard officer trainees tell the story.

We have, in recent months, given some thought to reducing the training period from four to three months. We feel that in this way we might be able to train four officers per year vice three.

If you or Mr. Panshin have any questions after reviewing the enclosures, please let me know.

Sincerely,

Harold D. Muth
Vice President-Government Relations

HDM:pr

Enclosures

[Extensive material accompanying this letter has been retained in the subcommittee files.]

MarineSafety
international

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October 27, 1980

Honorable Les AuCoin, Chairman
Ad Hoc Select Subcommittee on
Maritime Education and Training
U. S. House of Representatives
721 House Annex 1
Washington, D.C. 20515

Dear Mr. Chairman:

This is in reply to your October 10th letter asking for answers to three additional questions to be included in the record of the Subcommittee's September 9th hearing.

The questions and answers follow:

1. There are different types of bridge simulators. Which types, or in other words, how basic a simulator, would be adequate in training merchant marine officers for initial licensing?

The responsibilities facing an initially licensed third mate are primarily those of watchkeeping. While underway, the paramount concern is safe navigation of the vessel, whether in open ocean or coastal waters. Safe navigation is comprised of accurately maintaining the vessel's course, locating and monitoring the vessel's position at periodic intervals, avoiding other vessels and obstacles and maintaining the proper communications and records during the watch. Junior officers do virtually no shiphandling, therefore, any simulator which can "realistically" recreate the atmosphere and environment of being aboard a ship underway and address the problems of keeping course, avoiding traffic, and generally maintaining a proper watch would be acceptable.

A simple nighttime display would be sufficient since watchkeeping is a 24-hour activity. The important factor is the credibility of the simulation. For example: Does the ship appear to react in a realistic manner? Does whatever image presented look real or does it look artificial. (Spot projected lights on a black background can create a far more realistic image than cartoonish computer generated image presentations in full color.) Is the panorama actually viewed correct and accurate? (e.g., is the correct aspect of vessels, navigational lights, buoys and other navigational

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aids maintained as changes in own ship's bridge location as well as height of eye above the water occur?), and is the fidelity of the panorama of sufficient quality for the training objectives identified? These are subjective areas which can only be evaluated by experienced mariners.

2. In the event that simulators at maritime academies are used for continuing education programs, will these simulators compete at an unfair advantage with commercial simulators for purposes of training and upgrading seafarers?

Whether or not academy simulators used for continuing education will create unfair competition depends upon the source of funding of those simulators. Obviously, if tax money is used to provide, operate and maintain a training simulator when private enterprise is willing to do so with its own funds, the competition is unfair. On the other hand, if private enterprise provides whatever services are required by the academies the use of the hardware during non-contracted hours should be left to the discretion of the operator or as required by contract.

3. In your view, would it be more cost-effective for maritime academies to install sophisticated simulators such as the kind you manufacture, or could academies train their cadets just as well with a less complex simulator?

The ship simulator presently operated by MarineSafety International was not manufactured by it, although our parent company, FlightSafety International, now has a simulator division which could manufacture a ship simulator if required. However, as explained in our answer to question number 1, a less sophisticated simulator than the one we presently operate would be quite sufficient for training cadets because they are training to become good watchkeepers, not good shiphandlers. The cost-effectiveness in each case would depend upon the actual simulator in question, its capabilities, cost and intended utilization.

We believe that there should be no question that the United States should go on record certifying that existing programs meet the objectives of the proposed IMCO Requirements for Certification and Watchkeeping with respect to the 365 days seagoing experience. The record established by our merchant marine officers are proof of this. The use of simulator training is something to be considered to enhance the current training programs.

Thank you for the opportunity to present these additional views.

Sincerely,

Elmer G. Gleske

Elmer G. Gleske
Vice President

SHIP ANALYTICS

October 30, 1980

Honorable Les AuCoin
Chairman, AdHoc Select Committee
Maritime Education and Training
721 House Annex 1
Washington, DC 20515

Dear Congressman AuCoin,

I apologize for this late response to your October 10 letter; however, I have just returned from two weeks of travel. I trust this information will reach your committee in time for inclusion on the record.

In response to your first question, which was, "There are different types of bridge simulators; which types, or in other words, how basic a simulator would be adequate in training merchant marine officers for licensing?"

As I have pointed out in some of my earlier testimony, a simulator and its characteristics are selected based on a set of training objectives and training requirements for specific groups of trainees. Our firm manufactures and delivers complete training systems ranging from those containing very complex simulators, to systems containing simulators judged as relatively simple and basic. Our design approach is to specify, design, and manufacture the least complex simulator hardware to achieve the specific stated training requirements envisioned in the use of that simulator. A system for training merchant marine officers for initial licensing or at the cadet level can be addressed not only with my opinion, but with facts contained in a recent MarAd/U. S. Coast Guard study. This study, the Training and Certification project, showed that when Kings Point cadets were examined on the CAORF simulator, the following problems were uncovered.

A. Stand-on vessel action was taken too early with night only simulation, indicating some lack of confidence and potential problems complying with international rules of the road.

B. There was an apparent overemphasis on radar information in comparison with visual information; this suggests that basic radar or electronic display simulators would serve only to enhance this deficiency and suggests the need for a daylight visual scene.

N. Stonington Professional Center, N. Stonington, CT 06359, USA (203) 535-3092

C. Vessel handling problems under difficult conditions were observed, (e.g., a 40-knot wind). This suggests the need for a daylight scene to train or gain an appreciation for shiphandling in severe conditions.

D. There seemed to be a lack of understanding of the information available. Noted were difficulties understanding range lights and horizontal separation, stressing the need for high quality night visuals as well as day scenes.

Each of these potential problems points out the difficulty of training cadets on a simple simulator. For example, training and certifying cadets with only a nighttime scene may reinforce poor cadet behavior which is the tendency to turn too early. This could be particularly dangerous with respect to implementation of rule 17 and the requirement to stand on. Also the overemphasis on radar instrumentation information on a bridge which would not have an adequate visual scene would occur. This again is a common cadet fault which would only be reinforced by a basic simulator. Numerous ship operators would agree that the average cadet already displays too much interest in electronic information as opposed to learning to use his eyes. The need to obtain visual bearings and train cadets to use their visual skills suggests that any simulator for cadet training would require a daylight image. Point C regarding vessel handling also suggests that a nighttime simulator would not be adequate. In a nighttime visual scene, the concepts of handling the ship would not become apparent to a trainee since very little visual information is imparted regarding the yaw rate and fine handling characteristics of a ship in a night scene.

In summary, I would answer your question by stating that there is experimental evidence gathered on the Kings Point cadets in the course of a MarAd and U. S. Coast Guard study which suggests that a visual simulator which includes a daylight scene be required for such training. This would be judged as at least having medium to high complexity in the visual subsystem. Operating economies for a cadet simulator however, could potentially be achieved in the radar subsystem, in the bridge equipment and bridge design. Other data in the training device development area would suggest, however, increasing the complexity of the instructor station and trainee feedback displays and scoring. Complexity in this functional subsystem of the simulator will often double the effectiveness of the device.

Your second question was, "In the event that simulators at maritime academies are used for continuing education programs, will these simulators compete at an unfair advantage with commercial simulators for purposes of training and upgrading seafarers?"

I believe that to some extent the maritime academies will compete with commercial simulators for the training and upgrading of seafarers. However, I believe that this competition is both healthy and in keeping with parallels in other areas of education, namely, those of the state and private universities which offer continuing education in competition with commercial interests. The academies most probably will concentrate on training which would be generic in its origins, namely the rules of the road, basic shiphandling, etc. I would envision commercial simulators to concentrate on courses specifically tailored to individual ports, or other special curriculums required by the industry. Congressional intervention would be inappropriate in the

logical development of continuing education programs at these facilities which so closely parallel similar developments in our state university school systems which are also heavily federally subsidised with hardware and equipment facilities similar to those that we are discussing today. You should note that I take this position despite the fact that we offer numerical training on our simulator and plan to continue to do so on a profitable basis when the maritime academies achieve an operating status.

In response to your third question which was, "In your view, would it be more cost-effective for maritime academies to install sophisticated simulators such as the kind you manufacture, or would academies train their cadets as well with a less complex simulator?"

I should like to point out that our firm specifies, designs and manufactures both sophisticated simulators as well as less complex simulators as defined in your question. We design all of our simulators to be the least complex required to meet the training requirements at hand. As such, the range of costs for devices we manufacture for bridge skills simulator training is from $75,000 to over 3 million dollars. With an average system in the area of 3 million dollars. We believe that the academies should install a system which is of medium to high complexity in the visual system, a low complexity in the radar subsystem, a low to moderate complexity in the bridge equipment and bridge structure, and a very high complexity in the instructor station and trainee feedback displays. Our opinion regarding these levels of complexity is based on research, data, and an examination of the cadet training requirements. It is not based on a product configuration, which we routinely offer for sale, but rather is tailored to initial officer licensing training requirements. The implications of sacrificing fidelity with a less complex simulator particularly in the visual area or the instructor station would result in both training inefficiencies at the institutions, and perhaps most importantly, the potential of negative training resulting from, for example, a simple nighttime system, as I responded in your first question. In short, if the academies were to buy a less complex system, you might find trainees with original licenses who would actually be trained to enhance their existing deficiencies. Namely, they respond to vessel traffic too early, and not in accordance with the rules of the road, have a further overemphasis on the use of electronic information such as radar, have difficulty appreciating the handling problems of ships under poor environmental conditions such as wind, and lack a full understanding of visual information which is available to them, such as the use of visual bearings correlated with electronic bearings and full understanding of the operation of range lights which are not usually well simulated in most basic night systems. As I stated in prior testimony, I believe that the Coast Guard and MarAd through their previous sponsored research could prepare a sufficiently complete specification today for the purchase of simulators at all the various maritime academies and that these systems could be adequately specified to assure that a well-trained cadet is licensed under an American system of 6 or more months of at-sea time with the remainder in simulator training for equivalency, and further that these cadets trained with these configurations would be judged to be as good or superior to cadets or entry level officers from other countries having in excess of a year at-sea time.

Thank you for the opportunity to submit this additional information; I hope that it provides the committee with some clear insights regarding this important issue.

Sincerely yours,

Alan J. Pesch
President, Ship Analytics

AJP:lvc

HYDRONAUTICS, INCORPORATED
RESEARCH IN HYDRODYNAMICS
7210 PINDELL SCHOOL ROAD HOWARD COUNTY LAUREL, MARYLAND 20810 - TELEPHONE 776 7454

October 28, 1980

Hon. Les AuCoin, Chairman
Ad Hoc Select Subcommittee on
Maritime Education and Training
721 House Annex 1
Washington, D.C. 20515

Dear Mr. AuCoin:

In response to your letter of October 10, 1980 on answers to questions for the record of the September 9 oversight hearing, I would like to provide the following:

1. Q: "There are different types of bridge simulators. Which types, or in other words, how basic a simulator, would be adequate in training merchant marine officers for initial licensing."

A: I do not believe that a definitive answer to this question can be provided at this time. It is my understanding that MARAD and the U.S. Coast Guard are now involved in a research program that will develop some answers to this question. Hopefully this work will consider the use of "part task" as well as full capability simulators. It is likely that part task simulators can be much less costly than a full capability simulator and also be more efficient for a maritime academy. For example a Radar Simulator, a navigation light simulator and a ship handling simulator may be no more costly than one full capability simulator but could accommodate a significantly greater number of students in a given time.

At HYDRONAUTICS, our experience is with a simulator that could be considered a part task simulator for ship handling. Based on comments from experienced mariners who have operated the simulator we believe that this type of simulator would be useful for training. However, we have not conducted any experiments to specifically investigate training applications. We would very much like to participate in the on-going research program to determine the simulator capabilities required for the training of merchant marine officers for initial licensing. Our simulator facility could be made available for this purpose.

2. Q: In the event that simulators at maritime academies are used for continuing education programs, will these simulators compete at an unfair advantage with commercial simulators for purposes of training and upgrading seafarers.

A: It would seem that simulators at maritime academies would have the potential for competing with commercial simulators with an unfair advantage. This advantage would be one of cost if no requirement is placed on the academies to recover the appropriate capital costs. A possible approach would be to require the academies to include pre-defined capital costs in the costs of a continuing education program and to return these funds to the Government.

If you need any additional information, please contact me.

Sincerely,

HYDRONAUTICS, Incorporated

Eugene R. Miller Jr.

EUGENE R. MILLER, Jr.,
Vice President

ERM:vw

C.I. HILTZHEIMER
Chairman
Chief Executive Officer

September 5, 1980

The Honorable Les AuCoin
Chairman, Ad Hoc Select Subcommittee on Maritime Education and Training
U. S. House of Representatives
Washington, D.C. 20515

Dear Mr. AuCoin:

This letter is in response to your letter of August 1, 1980 to Ms. Rebecca Berg of R. J. Reynolds Industries, Inc. in Washington, D.C. regarding your Ad Hoc Select Subcommittee on Maritime Education and Training oversight hearings on September 9.

Sea-Land Industries, Investments, Inc. does not wish to testify at that hearing but would like the attached statement entered as part of the Subcommittee's record.

Please let me know if any additional information would be helpful to you.

Sincerely,

Charles I. Hiltzheimer

CIH:tp
attch.

cc: WASHINGTON, D.C. - R. Berg, Washington Representative, RJRI

SEA-LAND INDUSTRIES INVESTMENTS, INC. P.O. Box 900, Edison, New Jersey 08817: Tel: 201 494-2500

STATEMENT FOR THE RECORD OF THE AD HOC SELECT SUBCOMMITTEE
FOR MARITIME EDUCATION AND TRAINING OVERSIGHT HEARINGS
SEPTEMBER 9, 1980

Sea-Land Industries Investments, Inc. and its subsidiaries are engaged in various transportation ventures throughout the world. One of our subsidiaries, Sea-Land Service, Inc. is the world's largest privately owned containership company, operating 37 U.S. flag ships, serving 122 ports in 46 countries.

In furtherance of maintaining a strong and vital U.S. merchant fleet, we are keenly interested in maritime education and training. Thus we are appreciative of the opportunity to respond to your questions regarding education and training as well as commenting on current legislation HR 5451.

Question: How the changes expected to be brought about by implementation of the Convention on Standards for Certification, Training and Watchkeeping of Seafarers (1978) will affect maritime education and training as well as our policies and operations?

Answer:
It is our understanding that the Convention will require a minimum of one year of sea-going service in addition to an allowed two years of "approved special training". It is the requirement that one year be spent at sea which seems to be the primary concern of the representatives of the state supported training schools which rely heavily on their school ships to provide sea-going experience.

Sea-Land does not believe that implementation of the one year at sea regulation will have any effect upon the quality of junior officers presently being graduated from the various state schools and the federal academy at Kings Point. Nor do we expect the Convention to change the quality of junior officers produced from industry sponsored schools. All of these facilities have, in our opinion, eminently satisfactory programs for producing junior officers.

If the intent of the Convention is to upgrade the quality of junior officers entering the profession, and that would seem to be the case, then the approach taken by the Convention falls short of the mark. In our opinion, promotion of safety of life and property at sea and the protection of the marine environment would be better served by requiring the "Administrations", referred to in the Convention, to strengthen and improve their examination procedures for the licensing of junior officers.

We are told that new vessels are more complex to operate and manage than ever before. The value of a single ship can exceed the capital cost of an earlier operator's entire fleet. Yet we are still examining people entering the shipping field in practically the same subject matter that was included in the examinations of thirty years ago. There have been some changes which reflect the fact that the vessels of today are not the same as those of thirty years ago. These are, however, woefully inadequate and in some respects the examinations of today are definitely inferior to the former tests. I refer to the fact that the multiple choice question has supplanted the essay type examination question. The training schools prepare young people to pass their license examination. The schools will respond to tougher examinations by broadening and intensifying the training of young people desirous of entering the profession.

The objective of improved safety at sea can be better served by concentrating on the problems of personnel motivation and training rather than pursuing the ever increasing demands for more and more hardware on ships as if equipment of itself was capable of running an engine room or a bridge.

Question: How does Sea-Land help to train deck and engineering officers at sea?

Answer:
Sea-Land cooperates with the federal and state maritime academies by making berths available for deck cadets from the various institutions. These young men and women are given an opportunity to learn commercial vessel operation during periods at sea averaging about two months at a time. The only restriction upon their utilization as trainees is a routine caution to the Master of the vessel not to prejudice the provisions of the company's labor contracts with regard to work done on board by cadets. To the best of our knowledge, this has not been a problem of great consequence at any time.

Question: Recommendations for improvement in current sea training requirements.

Answer:
The question of when the cadet gets to go to sea is much more important that whether the sea-training is for six months, nine months or a year. Young men and women continue to be graduated from state schools and the federal academy who do not really care to follow a career at sea. It is hard to condemn any student for taking advantage of a free or low cost education opportunity. It is also reasonable to require an obligatory service for this free or low cost education. However, the real goal is to select young people with a genuine desire to follow a career at sea. Thus, it may be advisable to hold in abeyance the final selection for attendance at school until the candidate completes his or her sea-training period, which should be as early in the individuals training as is possible.

For example, in 1943 cadets received ninety days of basic training and were then sent to sea for a minimum stint of six months. Even bearing in mind that a wartime situation distorted the reality of the experience, the procedure nevertheless provided for an effective screening out of some individuals who did not have either the desire or aptitude for a sea-going career.

Question: Sea-Land's recommendations for improvement in proposed sea-training requirements. (presumably those of the 1978 Convention)

Answer:
One question that has been posed is whether school ship experience is superior to cadet training on commercial vessels. It is difficult to answer this question conclusively one way or the other. Masters and Chief Engineers abound who are products of both training systems. Complicating the matter is the unmistakable fact that many of our most competent and respected Masters and Chief Engineers "came up" through the ranks, and never attended a state school or the federal maritime academy.

If you wish to make a judgement on the basis of which training system (school ship experience or on board commercial vessels) offers the best return for the taxpayer's dollar I would recommend that you carefully consider a program wherein the money presently expended for the upkeep of state school ships that "cruise" for perhaps two months out of the year might be more productively used to support an expanded at-sea training activity on board commercial vessels.

For example, it has been brought to our attention that the question of berth availability for cadets on commercial vessels was studied in the past by the Maritime Administration. Also, that the conclusions reached by the study favor the continuation of the present operational procedures for school ships because of an existing inability to accommodate cadets at sea in sufficient numbers on commercial vessels. No doubt this is the present situation. What we are suggesting is that the money presently put into school ship operation might be sufficient to solve the problem of space availability if it was to be used for that purpose.

As a non-subsidized operator, Sea-Land has no legal obligation to accept cadets from the federal academy. We do carry cadets, however, because obviously it is in our own self interest to support such programs. While I know of no U.S. operator presently refusing to accept cadets on board ship, there may be circumstances which hinder such cooperation on the part of other operators.

Under certain conditions, perhaps peculiar to an individual situation, an operator may perceive of a need to conduct his own training of seafarers. Sea-Land Service recently completed a retraining program for senior engineers because of a need to prepare men to man our new diesel vessels. I am certain other carriers devise similar programs to meet their requirements. I mention this matter only because we are all aware of the fact that from time to time an operator must meet a need for training that may be unique. This makes it necessary to maintain a training establishment that can be tapped for expertise when the need arises. The larger the base of the training establishment the more apt one is to find the answer to ones particular training need.

With regard to the question of simulator training and its value vis-a-vis on the job training, it is important to identify just what is meant by simulator training and to identify the specific disciplines that we may wish to consider as candidates for simulator training.

For example, let us briefly examine the diesel engine control simulator at the Maine Maritime Academy, or the bridge simulator at the La Guardia field office of Marine Safety International. Both of these installations serve specific purposes and are extremely valuable tools for training. However, one sadly overlooked use of the simulators could be in the area of license examination. Consider, if you will, how much more valuable would be the results of a practical demonstration on a bridge simulator of a young officer's knowledge and understanding of rules of the road than to conduct a test of his knowledge by a series of multiple choice examination questions. It is clearly recognized that the numbers of simulators now available preclude a broad application, at this time, of the concept just referred to but it may be well to consider the value of such usage when evaluating requests for funding of simulator installations. Training on simulators can take the place of some on-the-job-training, which in the marine industry may simply equate to on-the-job-"observation" of what another person is doing. It is a rare master who will jeopardize his own career and license to permit a junior officer to practice ship handling. Yet we expect this young officer to be competent in that discipline once appointed to his first command. I would caution however that simulators are not all of equal quality insofar as duplication of the real world is concerned and placing an early heavy reliance on simulators as a training aid may result in some degradation of the quality of units to be placed in operation as people scramble to meet a designated need.

Finally I offer brief comments regarding HR 5451:

Add to Sec. 1303 (b) (2) (B) (P. 5, lines 14-20) the provision that final selection will be withheld until the candidates completes his or her initial sea-training period.

Strike from Sec. 1303 (b) (3) (D) (P. 8, lines 10-15) the reference to "without competition" and the reference to a "national demographic balance". There is no justification whatsoever for special treatment in appointments to the academy.

Strike from Sec. 1303 (b) (5) (A) (B) (C) (P. 9, line 17 - P. 10, line 6) the entire section. There is no justification for taxpayers of this country to subsidize the education of persons from other countries so that they can go out and compete against us.

Strike from Sec. 1303 (b) (6) (A) (B) etc. Reason as above.

Thank you for the opportunity to enter these comments in the record.

TESTIMONY OF REAR ADMIRAL GEORGE B. RECTOR
DIRECTOR, GREAT LAKES MARITIME ACADEMY

IN THE HOUSE OF REPRESENTATIVES
BEFORE THE AD HOC SELECT SUBCOMMITTEE ON
MARITIME EDUCATION AND TRAINING

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Mr. Chairman and Members of the Committee:

I am George B. Rector, Director of the Great Lakes Maritime Academy in Traverse City, Michigan. I wish to address the issue of how IMCO standards will affect maritime education and training at the Great Lakes Maritime Academy; and also, I wish to present some problems we are facing concerning sea training requirements on the Great Lakes.

The revised standards as proposed by the International Convention on Standards of Certification, Training, and Watchkeeping of Seafarers (1978) apply only to the certification and training of deep sea deck officers. The Great Lakes Maritime Academy deck officer program trains cadets to qualify for the First Class Pilot's License (Great Lakes) and not for the ocean Third Mate's License. Graduates of the Great Lakes Maritime Academy deck officer program normally seek employment as deck officers on U.S. vessels operating within the inland water system of the Great Lakes. The Great Lakes Maritime Academy engineering program prepares cadets to write for the Third Assistant Engineer's License (steam and motor vessels). It is my understanding that IMCO standards do not affect maritime education and training of U.S. Merchant Marine engineering officers.

Because of the limited number of U.S. flag vessels operating on the Great Lakes there is an absolute limit on the number of cadet training berths available. As we approach that limit with increasing enrollment it is becoming apparent that we must adjust the sea training requirements in both our deck officer and engineering officer programs.

I have submitted a proposal to the Maritime Administration of the U.S. Department of Commerce for reducing the required sea training requirements in our engineering officer program from 9 months to 6 months. This reduction would not only insure an adaquate number of cadet observer berths on U.S. Great Lakes vessels in the future, but it would also provide the opportunity for intensive shoreside laboratory training in several critical areas that is currently not available:

a. repair of equipment casualties
b. casualty control procedures
c. emergency procedures
d. lay up and fit out procedures that are particularly important for Great Lakes vessels

I feel that six months of sea training on commercial vessels is adaquate for qualifying cadets as engineering watchstanders. The special procedures listed above could be more effectively trught in laboratory situations with actual equipment plus simulators and during actual periods of vessel lay up and fit out.

The deck officer program at the Great Lakes Maritime Academy trains cadets to become Great Lakes pilots with an emphasis on ship handling techniques and the specific piloting procedures for safe navigation in the restricted waters of the Great Lakes and connecting waterways. With increasing enrollment we are approaching the same cadet berth limitations of a constant number of U.S. flag vessels. I feel that any reduction in the sea training requirements in our deck officer program would have to be compensated for by an equal amount of shiphandling simulator

training. Any shiphandling simulator utilized in our program would have to include the capability of duplicating the precise navigational situations encountered on the Great Lakes and its connecting waterways to qualify the cadet for the appropriate waters endorsements. Because of the emphasis on ship handling techniques in our deck officer program simulator training could advantageously add specific training experience in emergency procedures seldom encountered in actual shipboard training assignments.

I urge you to consider the acquisition of appropriate shiphandling simulator equipment for all state maritime academy deck officer programs as a substitute for a substantial percentage of present sea time requirements.

September 9, 1980

TEXAS A&M UNIVERSITY AT GALVESTON

MITCHELL CAMPUS P.O. BOX 1675 GALVESTON, TEXAS 77553

Office of
The Dean
Texas Maritime College

22 August 1980

The Honorable Les AuCoin, Chairman
Ad Hoc Select Subcommittee on Maritime Education and Training
721 House Annex 1
Washington, D. C. 20515

Dear Congressman AuCoin:

I appreciate the opportunity to comment on the issues to be considered by your Subcommittee during the oversight hearings to be conducted 9 September 1980. The areas of interest, as described in your letter of 1 August 1980, are changes in IMCO standards and the affect on maritime education and training and the policies of the Texas Maritime College, the evaluation of current and proposed sea training requirements and how best fulfilled, and comments on the use of training ships at the College.

IMCO STANDARDS AND AFFECTS

The changes proposed by the International Convention on Standards of Certification, Training, and Watchkeeping of Seafarers (1978), with the exception of the extended period of sea training required for the prospective Third Mate, would have little, if any significant affect upon the policies and operations of the Texas Maritime College.

Current policies at the Texas Maritime College permit the Maritime Service Cadet to sit for a license when the requirement for a minimum of three years in training as a cadet and six months of training at sea are satisfied. This policy derives from merchant marine training law now in effect. Training commences on the date the individual is enrolled as a Maritime Service Cadet, and the sea training requirement is satisfied by embarking in the TEXAS CLIPPER each summer for three training cruises. The ship is underway from early June until early August and visits ports in the Atlantic, Caribbean, and Gulf of Mexico areas. The Fall Semester commences in late August or early September and the Spring Semester completes in the first two weeks of May. Maritime Service Cadets are permitted leave from the time the CLIPPER returns to Galveston until the Corps of Cadets is required to return to the Campus several days in advance of the beginning of the Fall Semester.

One of the three required training cruises may be completed on board a United States Flag Fleet vessel. In 1980, 32 cadets were embarked in Flag Fleet vessels. These cadets were completing their second, or Junior training cruise. Senior Cadets are required on board the training vessel where they serve as Junior Officers.

Should the proposed IMCO standard of 12 months sea time be literally imposed, there would be significant impact upon the Texas Maritime College. Presumably, the cost of fuel would be doubled, or nearly so, the ancillary costs of all other services required by the training cruise would be significantly increased, and there is reasonable doubt that the institution would continue the license option program in the absence of heavy subsidies from outside sources. The record will show that the Texas Maritime Academy, in Fiscal year 1976, received 66% of financial contributions from the State, 21% from the Federal Government, 13% (12.3) from students, and 0.7% from private contributions. At present, contributions continue in the same proportion; however, 55% of the students attending as Maritime Service Cadets are non-residents.

Should the twelve month sea time rule be literally adopted, and the financial resources identified, significant scheduling problems would remain. The choice would seem to be four, three month cruises, in which a "freshman" cruise would be required, or three, four month cruises which would require a re-orientation of the academic schedule.

Presently, neither of these two options appear to be viable.

EVALUATION OF CURRENT AND PROPOSED SEA TRAINING REQUIREMENTS AND HOW BEST FULFILLED

The currently prescribed requirement for a minimum of three years in training and six months at sea has served the industry well for many years.

As Dean of the Texas Maritime College, I have embarked in the training ship for the 1978, 1979, and the recently completed 1980 training cruises, and have personally observed the training of our cadets. The training is consistent, well organized, and under the direct supervision of licensed officers who also serve on our faculty. The routine includes watch standing, training, and maintenance. Cadet watch standers, under supervision, control the ship. Training consists of formally organized and graded classroom instruction, and maintenance consists of repair of in-operable equipment, preventive maintenance to topside and engineering systems, and a considerable amount of chipping and painting of all topsides, living spaces, and public spaces.

In United States Flag Fleet vessels, training is available to a selected number of our junior cadets. In 1980, 32 of our cadets shipped in Flag vessels, this being an unusually large number. Previous years have averaged around 15. Flag Fleet training cruises are popular because the cadet is paid wages, as compared with paying tuition and fees for the cruise, currently averaging $1,200.00 exclusive of personal expense money. Cadets selected for Flag Fleet ships are those expected to acquit themselves well with a minimum of supervision. Each is enrolled in a Marine Transportation Course of four semester hours credit and must submit a report for grading upon the completion of the cruise, which must be at least 60 days duration. The report consists of ten or more "days work" in navigation, description of all operating systems in the ship, description of all the cargo handling equipment in the ship as well as a description of cargo operations. Those assigned to tankers are required to submit drawings of all piping layouts and cargo tanks. The cadets describe mooring systems used in the ports entered while on board, describe all lifesaving and safety equipment on board, and essentially complete the same syllabus as if on board the training ship, the difference being the degree of supervision.

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The training ship offers a superior means by which the prospective mariner may be trained. Formally organized courses of instruction, with well defined goals, carried out under the direct supervision of a qualified professional are highly effective. The independent, i.e., Flag Fleet cruise, is a valuable experience for properly motivated cadets and provides additional insight in the industry. On balance, it is not likely to be as effective for the average cadet as is the closely supervised training ship operation.

Ship handling and engine simulators have proven their value and there is no longer a question as to their utility. Each is a valuable addition to the training experience of the Maritime Service person.

USE OF THE TRAINING SHIP AT THE TEXAS MARITIME COLLEGE

The primary purpose of the training ship is to provide the means whereby the six month seatime requirement may be satisfied. When not cruising, the ship occupies a berth alongside the pier on Pelican Island, the location of the Mitchell Campus of the Texas A & M University at Galveston. The ship will continue to serve as a dormitory with 155 cadets living on board until a new 400 person dormitory has been completed. Dormitory construction has been approved and the construction contract is scheduled for award 26 August 1980.

Depending on the weather, and/or construction delays, plans call for occupying the dormitory in either the Fall of 1981 or the Spring of 1982. At that time the CLIPPER will no longer be required to serve as an auxillary dormitory.

The ship also serves as a "laboratory" for both deck and engine cadets. Deck cadets are taught cargo handling, boat handling, and the use of the ship's electronic navigation systems. Engine cadets are introduced to the practical examples of steam propulsion and geared turbines, operation and maintenance techniques in the engine auxillary system spaces of the ship. The larger public spaces, i.e., the forward and after promenades, and the main mess deck, serve regularly as classrooms.

The most significant feature of the TEXAS CLIPPER is the cost of operation, which tends to overshadow its general utility as an effective training vehicle. The cost of operation continues to increase as the ship ages, although there is a reasonable possibility that maintenance costs will level off temporarily if a significant rehabilitation effort, now planned by the Maritime Administration is carried out.

The increased cost of fuel oil has an obvious impact; however, the recent decision to permit the Secretary to help defray training fuel oil costs will help considerably. The estimated end of the useful life of the TEXAS CLIPPER is 1985. Should the Maritime Administration invest sufficient funds to rehabilitate the ship, it seems the useful life could be extended for a significant period of time.

The Texas Maritime College is on record as being in support of a dedicated full-time training ship or ships, which would appear to be the logical successor to a number of ageing ships now in use for training. Attractive as it may appear, considerable effectiveness in training would be lost should the Academies resort to the exclusive use of commercial ships.

In conclusion, a mixture of training ships, commercial cruises, and simulator training appear to offer the most effective means of training service cadets at this time. It is not particularly important that the individual states operate the ship, as long as the ship is responsive to the educational and training needs of the individual and the institution the ship serves.

Sincerely,

Kenneth G. Haynes
RADM USMS
Dean

KGH/sm

STATEMENT OF THE FEDERAL AVIATION ADMINISTRATION, BEFORE THE COMMITTEE ON MERCHANT MARINE AND FISHERIES, AD HOC SELECT SUBCOMMITTEE ON MARITIME EDUCATION AND TRAINING, CONCERNING SIMULATOR TRAINING. SEPTEMBER 9, 1980.

Mr. Chairman and Members of the Subcommittee:

The Federal Aviation Administration is pleased to have the opportunity to discuss the use of simulators in aviation in order to aid the Subcommittee in its study of the use of simulators in sea training.

As the state-of-the-art in simulator technology has advanced, more effective use has been made of the aircraft simulator in both the training and checking of flight crewmembers. The increasing complexity and operating costs of the modern turbojet and its operating environment point to greater use of the advanced technology now available in aircraft simulators. Simulators can provide more in-depth training than can be accomplished in the aircraft. There is also a very high percentage of transfer of learning from the simulator to the aircraft. The additional use of simulators in lieu of the aircraft results in safer flight training, great cost reductions for the operators, and achieves the benefit of fuel conservation and a decrease in noise pollution.

During the last 25 years, as simulator technology has improved, changes to the Federal Aviation Regulations (FAR) have been

made to allow the increased use of simulators in air carrier training programs. FAA acknowledgment of the value of simulator training began in 1954 when air carriers were allowed to perform all but four proficiency check maneuvers in a simulator. From this beginning, the FAA has continued to promote, evaluate, and regulate the use of simulation in aviation.

In the late 1960's, visual attachments appeared on the market. Since that time, a breakthrough in computerization has permitted the development of computer-generated image visual systems. In December 1973, amendments to the FAR permitted a simulator approved for the landing maneuver to be substituted for the aircraft in a pilot recency of experience qualification. These changes to the FAR constituted a significant step towards the development of the new amendment issued on June 24, 1980, which contains the FAA Advanced Simulation Plan. The new FAA rule outlines a three-step program for airlines to follow in upgrading their flight simulation capabilities to a point where nearly all required training activities and check rides can be carried out in advanced simulators. However, only experienced airline pilots will be allowed to participate in the advanced simulation plan.

Historically, pilot flight training requirements have been concentrated in a list of specific maneuvers and procedures required to be performed by a pilot on an individual basis. Examples include stalls, steep turns, various types of instrument approaches and landings. These maneuvers and procedures are fully set out in Appendices E and F to Part 121 of the FAR, which are enclosed for reference. Under this training philosophy, the measurement of an individual's capability to safely maneuver an aircraft has been how well he or she performs in these maneuvers and procedures. However, a recent study of airline accidents which involved pilot error seems to indicate that the pilot's ability to perform the skills required to physically maneuver the aircraft was not a factor. Rather, it seems that a lack of coordination between members of the flightcrew, and the failure to properly evaluate and manage an abnormal situation, were the primary factors which ultimately led to the accidents. So it would appear that the training needs of the airline pilot go beyond teaching that pilot the proper techniques, and physical skills to maneuver an aircraft.

The airline pilot is also required to receive training in how to perform as a part of a team--the team being the entire aircraft crew. We call this type of training "crew concept" training. By far, the most effective method of employing crew

concept training is through line oriented flight training (LOFT) which was recently introduced into the FAR. Under LOFT, an entire flightcrew is placed in a simulator, and is required to perform as a team through a flight segment which has been programmed into the simulator. During the flight segment, certain simulated abnormal and emergency situations are introduced, and the crew is required to deal with those situations without outside help from an instructor. LOFT has proved to be a very effective means of providing the extra training needed by an airline pilot to deal with situations requiring abilities beyond physically flying the aircraft. Realism in simulation is essential to the success of LOFT. If a simulator does not represent the physical and flight characteristics of the actual aircraft, and if the visual system does not adequately represent the flight environment, the flightcrew will not function as they would in a "real world" situation. This is why the FAA has placed such a great emphasis on the advancement of simulator technology.

The FAA's advanced simulation plan can be briefly outlined as follows:

The first phase of the plan can be conducted in existing simulators which have been upgraded to Phase I standards. Phase I permits pilots to meet various training requirements in simulators. This includes the "recency of experience" requirement, which specifies that pilots must have a minimum of

three takeoffs and landings within a 90-day period to remain qualified in a particular aircraft. Phase I also permits pilots to complete periodic proficiency checks which are required every 6 months for captains and 12 months for copilots and flight engineers in simulators approved under Phase I.

The second phase will require substantial simulator improvements, most of which are already achieveable. Among other things, simulators must be programmed for crosswind and wind shear effect, a variety of runway conditions, and brake and tire failure. Each Phase II simulator must be equipped with a six-axis motion system (pitch, roll, yaw, surge, sway, and heave). Also, visual systems must include dusk, as well as night scenes, improved weather presentations, and an expanded field of view of 75° horizontal and 30° vertical from each pilot position.

In this second phase, pilots will be allowed additional training and checks in simulators. For example, pilots can use simulators to transition from one airplane to another in the same group, e.g. from copilot of a Boeing 727 to copilot of a Boeing 707. It also will permit pilots to upgrade from copilot to pilot-in-command in the same aircraft type.
The third phase will permit nearly all training and check rides to be conducted in simulators approved under that phase,

including initial training for pilots who have not flown a certain type of airplane before.

Implementation of this final phase will require additional development by simulator manufacturers to produce equipment that can duplicate virtually every aspect of the real world of flight. For example, the simulator must be programmed to incoporate characteristic buffet motions, such as when the landing gear is extended or flaps deployed; realistic cockpit sounds and noises; and various inflight phenomena such as ground effect at low altitude and the effects of airframe icing. Visual systems also will need further upgrading to include realistic daylight presentations, special weather representations, and the capability for realistic protrayal of specific airport scenes.

FAA expects the new rules to stimulate airlines to upgrade their simulators to take full advantage of their capabilities in meeting training requirements. There are many advantages to the use of simulators in aviation training. It reduces the number of training flights, with a corresponding reduction in accidents, fuel consumption, and aircraft noise. The fuel savings alone are estimated to range from 32 million to 73 million gallons depending on how extensively the airlines utilize simulators. The greatest advantage of simulator

training is that this equipment can provide operational experience in normal operating procedures, abnormal operating procedures, emergency procedures, any weather condition, any lighting condition, any airport location, and training situations which would be impossible or unsafe to conduct in a real aircraft in flight, such as wind shear or a blown tire on landing.

A review of accident data shows that the cause of most accidents is lack of pilot experience in dealing with abnormal flight situations, rather than the pilot's inability to control the aircraft or perform specific maneuvers. Thus simulator training can enhance safety by providing experience in these abnormal flight situations, which could not be obtained in the actual aircraft. In addition, simulator training can be utilized 24 hours a day, 365 days a year, in any building large enough to hold the equipment. All of this adds up to training flexibility with maximum safety.

We have only discovered two possible drawbacks to the use of simulators. The first is that if the simulation is not good, training on the simulator can be counterproductive, either by teaching the pilot bad habits or by instilling in the pilot a false sense of confidence. This problem can be eliminated by ensuring that the simulators do in fact reproduce reality, both

in terms of external conditions and the responsiveness of the "aircraft." For this reason, the FAA has published extensive requirements for simulators in FAR §121.407 and Appendix H to Part 121.

The other possible drawback is the high procurement cost of a sophisticated simulator. An advanced simulator can easily cost $4 to $6 million. For a major airline with many pilots to train on expensive aircraft, the reduction in the number of aircraft that need to be diverted to training flights and the concommitant savings in fuel will more than offset the expense of procuring the simulator. For smaller companies training pilots in less sophisticated aircraft, the cost of owning an advanced simulator may be prohibitive. Where small numbers of a particular type of aircraft are in operation, simulators may not currently exist. For this reason, the FAA has never required the use of simulators. Rather our regulations have always been permissive, allowing the operator to substitute the use of approved simulators for flight training and checking if the operator so chooses. Naturally, an operator will not opt to purchase a simulator unless it does not exceed the cost of the flight training in the aircraft. However, all operators of large Turbojet aircraft today either own their own simulator or lease simulator time from other operators.

A copy of our June 30 rule on the use of advanced simulation has been attached to this statement for the Subcommittee's information. The FAA will be pleased to provide the Subcommittee with any further information which would assist in its inquiry.

Appendix E

Flight Training Requirements

The maneuvers and procedures required by section 121.424 for pilot initial, transition, and upgrade flight training are set forth in this appendix and must be performed inflight except to the extent that certain maneuvers and procedures may be performed in an airplane simulator with a visual system (visual simulator), an airplane simulator without a visual system (non-visual simulator), a training device, or a static airplane as indicated by the appropriate symbol in the respective column opposite the maneuver or procedure.

Whenever a maneuver or procedure is authorized to be performed in a non-visual simulator, it may be performed in a visual simulator; when authorized in a training device, it may be performed in a visual or non-visual simulator, and in some cases, a static airplane. Whenever the requirement may be performed in either a training device or a static airplane, the appropriate symbols are entered in the respective columns.

For the purpose of this appendix, the following symbols mean—

P	=	Pilot in Command (PIC)
S	=	Second in Command (SIC)
B	=	PIC and SIC
F	=	Flight Engineer
PJ	=	PIC transition Jet to Jet
PP	=	PIC transition Prop. to Prop.
SJ	=	SIC transition Jet to Jet
SP	=	SIC transition Prop. to Prop.
AT	=	All transition categories (PJ, PP, SJ, SP)
PS	=	SIC upgrading to PIC (same airplane)
SF	=	Flight Engineer upgrading to SIC (same airplane)
BU	=	Both SIC and Flight Engineer upgrading (same airplane)

See tables on following pages.

§ 121.631 Alternate airport for destination; Flag air carriers.

(a) * * *

(1) The flight is scheduled for not more than 6 hours and, for at least 1 hour before and 1 hour after the estimated time of arrival at the destination airport, the appropriate weather reports or forecasts, or any combination of them, indicate the ceiling will be:

' At least 1,500 feet above the lowest circling MDA, if a circling approach is required and authorized for that airport; or

(ii) At least 1,500 feet above the lowest published instrument approach minimum or 2,000 feet above the airport elevation, whichever is greater; and

(iii) The visibility at that airport will be at least 3 miles, or 2 miles more than the lowest applicable visibility minimums, whichever is greater, for the instrument approach procedures to be used at the destination airport; or

* * * * *

§ 121.691 [Reserved]

17. By deleting § 121.691 and marking it [Reserved].

18. By amending § 121.693 by inserting the words "loading of the" between the words "the" and "airplane" in the introductory phrase of the section and by revising the title and § 121.693(e) to read as follows:

§ 121.693 Load manifest: Air carriers and commercial operators.

* * * * *

(e) Names of passengers, unless such information is maintained by other means by the air carrier or commercial operator.

§ Part 121 Appendix E [Amended].

19. By amending Appendix E of Part 121 as follows:

1. Item I(a) by adding the followwing sentence at the end:

* * * If a flight engineer is a required crewmember for the particular type of airplane, the visual inspection may be replaced by using an approved pictorial means that realistically portrays the location and detail of preflight inspection items.

2. Item III(g)(3) by:

a. Deleting the symbols "B", "AT", and "BU" from the "Inflight" column under the captions "Initial Training", "Transition Training", and "Upgrade Training";

b. Adding the "B" symbol in the "Non-Visual Simulator" column under the caption "Initial Training";

c. Adding the "AT" symbol in the "Non-Visual Simulator" column under the caption "Transition Training"; and

d. Adding the "BU" symbol in the "Non-Visual Simulator" column under the caption "Upgrade Training."

3. Item III(h) by deleting the "P" symbol in the "Inflight" column and by adding the "P" symbol in the "Non-Visual Simulator" column under the caption "Initial Training."

4. Items III(i) and (j) by:

a. Deleting the "B" symbols in the "Inflight" column under the caption "Initial Training";

b. Adding the "B" symbols in the "Non-Visual Simulator" column under the caption "Initial Training";

c. Deleting the "SF" symbol in the "Inflight" column and deleting "PS" in the "Non-Visual Simulator" column under the caption "Upgrade Training"; and

d. Adding the "BU" symbol in the "Non-Visual Simulator" column under the caption "Upgrade Training."

5. Items III(p) (1) and (4) by deleting the "B" symbols in the "Inflight" column and adding the "B" symbols in the "Visual Simulator" column under the caption "Initial Training."

PART 127—CERTIFICATION AND OPERATIONS OF SCHEDULED AIR CARRIERS WITH HELICOPTERS

20. By redesignating § 127.115 as paragraph (a) and by adding a new paragraph (b) to read as follows:

§ 127.115 Passenger information.

(a) * * *

(b) After Aug. 31, 1981, no person may operate a passenger-carrying helicopter under this part unless there is affixed to each forward bulkhead and each passenger seat back a sign or placard that reads "Fasten Seat Belt While Seated." These signs or placards need not meet the requirements of paragraph (a) of this section.

21. By adding a new § 127.229 to read as follows:

§ 127.229 Briefing passengers after takeoff.

After each takeoff of a helicopter that has separate passenger and crew compartments, immediately before or immediately after turning the seat belt sign off, an announcement shall be made that passengers should keep their safety belts fastened while seated, even when the seat belt sign is off.

(Secs. 313, 314, 601 through 610, Federal Aviation Act of 1958 (49 U.S.C. 1354, 1355, 1421 through 1430); Sec. 6(c), Department of Transportation Act (49 U.S.C. 1655(c)))

Note.—The FAA has determined that this document involves a regulation which is not significant under Executive Order 12044, as implemented by Department of Transportation Regulatory Policies and Procedures (44 FR 11034, February 26, 1979). A copy of the final evaluation prepared for this document is contained in the docket. A copy of it may be obtained by writing to the individual and address listed in the "For Further Information Contact" paragraph.

Issued in Washington, D.C., on June 16, 1980.

Langhorne Bond,

Administrator.

[FR Doc. 80-19097 Filed 6-18-80; 8:45 am]

BILLING CODE 4910-13-M

FLIGHT TRAINING REQUIREMENTS

Maneuvers/Procedures	Initial Training					Transition Training					Upgrade Training				
	Airplane		Simulator			Airplane		Simulator			Airplane		Simulator		
	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device
As appropriate to the airplane and the operation involved, flight training for pilots must include the following maneuvers and procedures:															
I. Preflight.															
(a) Visual inspection of the exterior and interior of the airplane, the location of each item to be inspected, and the purpose for inspecting it.		B					AT					BU			
(b) Use of the preflight check list, appropriate control system checks, starting procedures, radio and electronic equipment checks, and the selection of proper navigation and communications radio facilities and frequencies prior to flight.				B					AT					BU	
(c) Taxiing, taxiing, and docking procedures in compliance with instructions issued by the appropriate Traffic Control Authority or by the person conducting the training.	B					AT					BU				
(d) Pretakeoff checks that include powerplant checks.				B					AT					BU	
II. Takeoffs.															
(a) Normal takeoffs which, for the purpose of this maneuver, begin when the airplane is taxied into position on the runway to be used.	B					AT					BU				
(b) Takeoffs with instrument conditions simulated at or before reaching an altitude of 100 feet above the airport elevation.			B					AT					BU		
(c) Cross wind takeoffs.	B					AT					BU				

EXCEPT TRANS PILOT ONLY IS REQUIRED POINT OF ORIGIN IS SAME AIRLINE SIM

FLIGHT TRAINING REQUIREMENTS—Continued

Maneuvers/Procedures	Initial Training					Transition Training					Upgrade Training				
	Airplane		Simulator			Airplane		Simulator			Airplane		Simulator		
	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device
(d) Takeoffs with a simulated failure of the most critical powerplant—			B					AT					BU		
(1) At a point after V_1 and before V_2 that in the judgment of the person conducting the training is appropriate to the airplane type under the prevailing conditions; or															
(2) At a point as close as possible after V_1 when V_1 and V_2 or V_1 and V_r are identical; or															
(3) At the appropriate speed for multiengine category airplanes.															
For transition training in an airplane group with engines mounted in similar positions, or from wing-mounted engines to aft fuselage-mounted engines, the maneuver may be performed in a ground simulator.															
(e) Rejected takeoffs accomplished during a normal takeoff run after reaching a reasonable speed determined by giving due consideration to aircraft characteristics, runway length, surface conditions, wind direction and velocity, brake heat energy, and any other pertinent factors that may adversely affect safety or the airplane.				B					AT					BU	
Training in at least one of the above takeoffs must be accomplished at night. For transitioning pilots this requirement may be met during the operating experience required under § 121.434 of this Part by performing a normal takeoff at night when a check airman serving as pilot-in-command is occupying a pilot station.															

FLIGHT TRAINING REQUIREMENTS—Continued

Maneuvers/Procedures	Initial Training					Transition Training					Upgrade Training				
	Airplane		Simulator			Airplane		Simulator			Airplane		Simulator		
	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device
III. Flight Maneuvers and Procedures:															
(a) Turns with and without spoilers				S					AT					SU	
(b) Tuck and Mach buffet				S					AT					SU	
(c) Maximum endurance and maximum range procedures				S					AT					SU	
(d) Operation of systems and controls at the flight engineer station				S					AT					PS	
(e) Runaway and jammed stabilizer procedures				S					AT					SU	
(f) Normal and abnormal or alternate operation of the following systems and procedures:															
(1) Pressurization					S					AT					SU
(2) Pneumatic					S					AT					SU
(3) Air conditioning					S					AT					SU
(4) Fuel and oil		S			S		AT			AT		SU			SU
(5) Electrical		S			S		AT			AT		SU			SU
(6) Hydraulic		S			S		AT			AT		SU			SU
(7) Flight control		S			S		AT			AT		SU			SU
(8) Anti-icing and de-icing				S					AT					SU	
(9) Auto-pilot				S					AT					SU	
(10) Automatic or other approach aids				S					AT					SU	
(11) Stall warning devices, stall avoidance devices, and stability augmentation devices				S					AT					SU	
(12) Airborne radar devices				S					AT					SU	
(13) Any other systems, devices, or aids available				S					AT					SU	
(14) Electrical, hydraulic, flight control, and flight instrument system malfunctioning or failure		S			S		AT			AT		SU			SU
(15) Landing gear and flap systems failure or malfunction		S			S		AT			AT		SU			SU

FLIGHT TRAINING REQUIREMENTS—Continued

Maneuvers/Procedures	Initial Training					Transition Training					Upgrade Training				
	Airplane		Simulator			Airplane		Simulator			Airplane		Simulator		
	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device
(10) Failure of navigation or communications equipment.				B					AT					BU	
(g) Flight emergency procedures that include at least the following:															
(1) Powerplant, heater, cargo compartment, cabin, flight deck, wing, and electrical fires.		B			B		AT			AT		BU			BU
(2) Smoke control		B			B		AT			AT		BU			BU
(3) Powerplant failures	B					AT					BU				
(4) Fuel jettisoning		B			B		B			B		BU			BU
(5) Any other emergency procedures outlined in the appropriate flight manual.				B					AT					BU	
(h) Steep turns in each direction. Each steep turn must involve a bank angle of 45 degrees with a heading change of at least 180 degrees but not more than 360 degrees.	P								PJ					PS	
(i) Approaches to stalls in the takeoff configuration (except where the airplane uses only a zero-flap configuration), in the clean configuration, and in the landing configuration. Training in at least one of the above configurations must be accomplished while in a turn with a bank angle between 15 and 30 degrees.	B								AT		SF			PS	
(j) Recovery from specific flight characteristics that are peculiar to the airplane type.	B								AT		SF			PS	
(k) Instrument procedures that include the following:															
(1) Area departure and arrival				B					AT					BU	
(2) Use of navigation systems including adherence to assigned radials.				B					AT					BU	

FLIGHT TRAINING REQUIREMENTS—Continued

Maneuvers/Procedures	Initial Training					Transition Training					Upgrade Training				
	Airplane		Simulator			Airplane		Simulator			Airplane		Simulator		
	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device
(3) Holding				B					AT					BU	
(i) ILS instrument approaches that include the following:															
(1) Normal ILS approaches	B					AT					BU				
(2) Manually controlled ILS approaches with a simulated failure of one powerplant which occurs before initiating the final approach course and continues to touch down or through the missed approach procedure.	B							AT					BU		
(ii) Instrument approaches and missed approaches other than ILS which include the following:															
(1) Nonprecision approaches that the trainee is likely to use					B					AT					BU
(2) In addition to subparagraph (1) of this paragraph, at least one other nonprecision approach and missed approach procedure that the trainee is likely to use.			B					AT					BU		
In connection with paragraphs III(h) and III(l), each instrument approach must be performed according to any procedures and limitations approved for the approach facility used. The instrument approach begins when the airplane is over the initial approach fix for the approach procedure being used (or turned over to the final approach controller in the case of GCA approach) and ends when the airplane touches down on the runway or when transition to a missed approach configuration is completed.															

227

222

FLIGHT TRAINING REQUIREMENTS—Continued

Maneuvers/Procedures	Initial Training					Transition Training					Upgrade Training				
	Airplane		Simulator			Airplane		Simulator			Airplane		Simulator		
	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device
(e) Circling approaches which include the following:	B							AT					BU		
(1) That portion of the circling approach to the authorized minimum altitude for the procedure being used must be made under simulated instrument conditions.															
(2) The circling approach must be made to the authorized minimum circling approach altitude followed by a change in heading and the necessary maneuvering (by visual reference) to maintain a flight path that permits a normal landing on a runway at least 90 degrees from the final approach course of the simulated instrument portion of the approach.															
(3) The circling approach must be performed without excessive maneuvering, and without exceeding the normal operating limits of the airplane. The angle of bank should not exceed 30 degrees.															
Training in the circling approach maneuver is not required for a pilot employed by a certificate holder subject to the operating rules of Part 121 of this chapter if the certificate holder's manual prohibits a circling approach in weather conditions below 1000-3 (ceiling and visibility); for a SIC if the certificate holder's manual prohibits the SIC from performing a circling approach in operations under this Part.															
(f) Zero flap approaches	P							PP, PI					PS		

223

FLIGHT TRAINING REQUIREMENTS—Continued

Maneuvers/Procedures	Initial Training					Transition Training					Upgrade Training				
	Airplane		Simulator			Airplane		Simulator			Airplane		Simulator		
	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device
Training in this maneuver is not required for a particular airplane type if the Administrator has determined that the probability of flap extension failure on that type airplane is extremely remote due to system design. In making this determination, the Administrator determines whether training on slats only and partial flap approaches is necessary.															
(a) Missed approaches which include the following:															
(1) Missed approaches from ILS approaches	B							AT					BU		
(2) Other missed approaches					B					AT					BU
(3) Missed approaches that include a complete approved missed approach procedure.					B					AT					BU
(4) Missed approaches that include a powerplant failure	B							AT					BU		
IV. Landings and Approaches to Landings.															
(a) Normal landings	B					AT					BU				
(b) Landing and go around with the horizontal stabilizer out of trim	P							P1, PP					P5		
(c) Landing in sequence from an ILS instrument approach	B							AT					BU		
(d) Cross wind landing	B					AT					BU				
(e) Maneuvering to a landing with simulated powerplant failure, as follows:															
(1) Except as provided in subparagraph (2) of this paragraph, in the case of 3-engine airplanes, maneuvering to a landing with an approved procedure that approximates the loss of two powerplants (center and one out board engine).	P							P1, PP					P5		
(2) Except as provided in subparagraph (3) of this paragraph, in the case of other multi-	P							P1, PP					P5		

223

224

Maneuvers/Procedures	Initial Training					Transition Training					Upgrade Training				
	Airplane		Simulator			Airplane		Simulator			Airplane		Simulator		
	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device
engine airplanes, maneuvering to a landing with a simulated failure of 50 percent of available powerplants, with the simulated loss of power on one side of the airplane.															
(3) Notwithstanding the requirements of subparagraphs (1) and (2) of this paragraph, flight crewmembers who satisfy these requirements in a visual simulator must also:															
(i) Take inflight training in one-engine inoperative landings; and															
(ii) In the case of a second-in-command upgrading to a pilot-in-command and who has not previously performed the maneuvers required by this paragraph in flight, meet the requirements of this paragraph applicable to initial training for pilots-in-command.															
(4) In the case of flight crewmembers other than the pilot-in-command, perform the maneuver with the simulated loss of power of the most critical powerplant only.															
(f) Landing, under simulated circling approach conditions (exceptions under III(a) applicable to this requirement).	B	.....	.....	.....	.....	.....	.....	AT	.....	.....	.....	.....	BU	.....	.....
(g) Rejected landings that include a normal missed approach procedure after the landing is rejected. For the purpose of this maneuver the landing should be rejected at approximately 50 feet and approximately over the runway threshold.	B	.....	.....	.....	.....	.....	.....	AT	.....	.....	.....	.....	BU	.....	.....

Maneuvers/Procedures	Initial Training					Transition Training					Upgrade Training				
	Airplane		Simulator			Airplane		Simulator			Airplane		Simulator		
	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device	Inflight	Static	Visual Simulator	Non-Visual Simulator	Training Device
(h) Zero-flap landings if the Administrator finds that maneuver appropriate for training in the airplane.	P							PP,PJ					PS		
(i) Manual reversion (if appropriate)			B					AT					BU		
Training in landings and approaches to landings must include the types and conditions provided in IV(a) through (i) but more than one type may be combined where appropriate. Training in one of the above landings must be accomplished at night. For transitioning pilots, this requirement may be met during the operating experience required under § 121.434 of this Part by performing a normal landing when a check pilot serving as pilot-in-command is occupying a pilot station.	B					AT					BU				

federal register

Monday
June 30, 1980

Part V

Department of Transportation

Federal Aviation Administration

Advanced Simulation

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 61 and 121

[Docket No. 19758; Amdts. Nos. 61-69 and 121-161]

Advanced Simulation

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: This rule: (1) Allows expanded training, checking, and certification of flight crewmembers in advanced flight training simulators, and (2) Encourages operators to upgrade their simulators and to perform a higher percentage of training in simulators so that the total scope of flightcrew training is enhanced. The benefits of this rule include substantially improved safety, fuel conservation, and a reduction of airport congestion. In addition, this rule offers a regulatory alternative which could result in significant cost savings for air carriers and represents a significant step in President Carter's program to reduce regulatory burdens through development of alternatives.

EFFECTIVE DATE: July 30, 1980.

FOR FURTHER INFORMATION CONTACT: H. E. Smith, Regulatory Projects Branch (AVS-24), Safety Regulations Staff, Associate Administrator for Aviation Standards, Federal Aviation Administration, 800 Independence Avenue, S.W., Washington, D.C. 20591, telephone (202) 755-8716.

SUPPLEMENTARY INFORMATION:

History

This final rule is based on Notice of Proposed Rule Making (NPRM) No. 79-18, published in the Federal Register on November 13, 1979 (44 FR 65550). All interested persons have been given an opportunity to participate in the making of the rule, and due consideration has been given to all matter presented.

Background

As the state-of-the-art in simulator technology has advanced, more effective use has been made of the airplane simulator in training, checking and certification of flight crewmembers. Simulators can provide more indepth training than can be accomplished in the airplane with a very high percentage of transfer of learning from the simulator to the airplane. There are many advantages in the use of *good* simulators for training.

1. Who can be trained?
   a. Entire flightcrew.
   b. Individual flight crewmembers.
2. What training can be accomplished?
   a. Normal operations procedures.
   b. Abnormal operations procedures.
   c. Emergency procedures.
   d. Any weather condition.
   e. Any lighting condition.
   f. Any airport location.
   g. Training situations which would be impossible or unsafe to conduct in the aircraft, such as wind shear or blown tire on landing.
3. When can training occur?
   a. 24 hours a day.
   b. Any day of the year.
4. Where can the training take place?
   a. Any building that can house the simulator.
   b. Any place in the world.

All of this adds up to training flexibility with maximum safety. In addition, the use of simulators instead of the airplane results in great cost reductions for the operator and achieves the benefit of fuel conservation and a decrease in airport noise.

During the last 33 years, as simulator technology has improved, changes to the Federal Aviation Regulations (FAR) were made to allow the increased use of simulators in air carrier training programs. FAA acknowledgment of the value of simulator training began in 1954 when air carriers were allowed to perform all but four proficiency check maneuvers in a simulator. From this beginning, the FAA has continued to promote, evaluate, and regulate the use of simulation in aviation. In the late 1960's visual attachments appeared on the market. Since that time, a breakthrough in computer technology has permitted the development of computer-generated image (CGI) visual systems. In December 1973, FAR Amendments 61-62 and 121-108 were issued which allowed additional training in visual simulators. Because many training maneuvers, such as engine failure on takeoff and visual approaches, require visual cues to provide the necessary training, these amendments resulted in reducing airplane flight training to approximately 1½ hours for an airline transport pilot certificate. Because of the limitations of simulators at that time, the 1½ hours of actual flight time was necessary to train the pilot to land the airplane, fly other maneuvers, and to become familiar with the feel of the airplane before the FAA certification check. A 1978 amendment to § 121.439 (Amendment 121-149) allowed a simulator approved for the landing maneuver to be substituted for the airplane in a pilot recency of experience qualification. The landing maneuver approval program associated with that rule change and its simulator approval criteria constituted a significant step toward the optimum utilization of airplane simulators in flight training and checking.

Based on the success of the landing maneuver approval program, FAA industry operational studies, and a review of the latest simulator technology, the FAA proposed its advanced simulation plan in Notice 79-18 to outline the steps for optimum utilization of airplane simulators.

Notice 79-18 proposed to amend §§ 61.157 and 121.407 to allow expanded training, checking, and certification of flight crewmembers in an advanced flight training simulator if that simulator—

(1) Is approved under § 121.407 of Part 121 and meets the appropriate simulator requirements of Appendix H to Part 121; and

(2) Is used as part of an approved program that meets the training requirements of § 121.424(a) and (c) and Appendix H to Part 121.

The notice further proposed a new Appendix H to Part 121. This Appendix provides criteria and a means for achieving approval of advanced airplane simulators for flightcrew training and checking. This plan for achieving the goal of advanced simulation consists of three major phases and an interim phase to facilitate the plan's implementation. The three-phase plan provides guidance through a progressive upgrade of flightcrew training simulators so that the total scope of flightcrew training can be enhanced. Each phase encompasses the preceding phase so that the final advanced simulation phase includes all the requirements of preceding phases. Appendix H describes the simulator and visual system requirements which must be achieved to obtain approval of certain types of training in the simulator. The requirements in the Appendix are in addition to the simulator approval requirements in § 121.407.

Phase I

Phase I is the current landing approval program. The training permitted under this phase is currently authorized for fully qualified air carrier pilots by § 121.439 and through FAA exemptions. Phase I is designed to encourage operators to upgrade their older simulators to the greatest extent possible.

Phase II

Phase II is designed to provide new simulator training capabilities by expanding the ability of the simulator to portray the ground and flight

environment and increasing the simulator's responsiveness. In addition to upgrading the simulator, a special 4-hour Line Oriented Flight Training (LOFT) course is required after the appropriate Part 61 or 121 simulator check. This course must be approved by the Administrator and be designed to prepare the flight crewmember for line operations. Under Phase II, transition and upgrade training and checking are accomplished in a simulator. Transition training is the training required for a pilot to move from one airplane to another in the same airplane group, for example, copilot B-727 to copilot B-707. Upgrade training, as it is applied in this rule, is upgrading from copilot to captain. At the completion of a Part 61, Appendix A, check in the simulator, an appropriate airman certificate or an airplane rating, or both, will be issued. Instructors used in these Phase II training programs, as well as pilots who participate, must be highly experienced. The pilots must be qualified at least as second in command in an airplane in the same group and must meet the requirements of Appendix H before being eligible for Phase II certification.

Phase IIA

Under Phase IIA, any Part 121 operator may conduct Phase II training for 3½ years in a simulator approved for the landing maneuver under Phase I, if the operator meets the additional requirements in Appendix H and submits a plan for approval by the Administrator to upgrade its simulator(s) to meet the Phase II standards. This interim program is designed to provide time and economic benefit to an operator to upgrade its simulators while ensuring safety through additional training requirements. Through the upgrading of industry simulators, further training in adverse conditions experienced in the operations will be possible.

Each Part 121 operator who submits an acceptable simulator upgrade plan to the Administrator before July 30, 1981 may apply for approval to use a Phase I simulator for transition and upgrade training as described in Phase II of the plan. When Phase II simulator requirements are met, the additional training requirements specified in Phase IIA, except the 4 hours of LOFT training discussed above, are removed. Other Part 121 training and operating experience requirements still apply.

Phase IIA interim approval ends for each Phase I simulator listed in the operator's approved plan 3½ years after it is approved for Phase IIA training. Approval of the plan will be withdrawn if any simulator is not upgraded according to the operator's approved simulator upgrade plan. This would result in loss of all Phase IIA training. Extension of Phase IIA training will not be considered because the comprehensive goal of the plan for simulator upgrade would be moribund if the plan were not implemented as developed and approved.

Phase III

Phase III is designed to allow all but static airplane training, the line check, and operational line experience to be conducted in an advanced airplane simulator. At the completion of the final simulator check, the applicant will receive the appropriate certificate or rating. Due to the scope of the training and the possible low experience level of the training candidates, a high degree of simulator fidelity and realism is mandatory. (Applicants must still meet the requirements for an airline transport pilot certificate, including 1500 hours of pilot flight time, to be eligible for that certificate under this plan.) This phase is also designed to guide research in simulator technology to meet training needs determined from airplane accident investigations. The visual requirements of Phase II must also be represented in daylight, dusk, and night scenes under Phase III. Therefore, night and dusk scenes may not be degraded under Phase III.

The advanced simulation plan outlined in Appendix H applies only to an operator who uses the simulator under an approved Part 121 training program. To conduct total initial, transition, upgrade, or recurrent training in a simulator under the plan, all required simulator instruction and checks must be conducted in a simulator as part of an approved advanced simulation training program. The training program would integrate Phase II and III simulators with other simulators and training devices to maximize the total training, checking, and certification functions. Certificates issued during Phase IIA will contain a limitation which requires the pilots to operate under Part 121 until they have met the line operating experience requirements of Appendix H.

Discussion of Benefits

Safety. In the past few years significant developments in simulator technology have made it possible to realistically simulate a specific airplane and its ground and flight environment. By taking advantage of the developments in the state-of-the-art of airplane simulators, flightcrew training could be upgraded from a strictly maneuver and procedures-oriented program to a program where crewmembers can also gain experience in dealing with abnormal flight, system, and environmental situations. This can be illustrated by comparing current flightcrew simulator training with improved training now possible in advanced simulators. Current flightcrew training is based on the maneuvers which have been historically conducted in the airplane. These maneuvers include stalls, steep turns, instrument approaches and airplane engine and system failures. Since current training is based on that which can be accomplished in an airplane, the training is procedurally oriented and designed to avoid placing the airplane in an unsafe condition. Simulators have been able to provide maneuvers training including airplane engine and system failures training so that, for example, training in a critical-field-length engine failure on takeoff maneuver can be conducted safely and realistically. However, because simulators have been designed to provide only the types of maneuver training that have been historically conducted in the airplane, they have not been capable of providing training in different flight environments, such as near thunderstorms or on icy runways which might be encountered on line flights. This type of training can be conducted in advanced simulators.

A review of NTSB accident statistics shows that pilot error and adverse weather conditions are the primary causes of most air carrier accidents. This review indicates that it is not the pilot's inability to control the airplane or to fly a specific maneuver but rather the failure of the crew to deal with the abnormal flight situation which causes the accidents. Improved training including line oriented flight training in advanced simulators could be the most significant means for reducing these types of accidents.

Under the FAA's advanced simulation plan, which is implemented in this rule, simulators will have the capability to be programed to represent a full range of airplane flight conditions as well as specific airplane accidents in abnormal environmental conditions. In this way flightcrews could experience a far-ranging set of flight environments and malfunctions. This could assist the crew in making proper judgments when abnormal situations occur in flight. Safety would, therefore, be enhanced dramatically by producing better trained pilots. Without upgrading simulators, upgrading training to this extent will be impossible. Safety would also be greatly increased because advanced training simulators can provide training without

the risk of airplane training accidents. Since 1962 U.S. air carriers have experienced 67 training accidents of which 6 were fatal accidents. In the future, training accidents could be avoided through use of advanced simulation.

Energy Savings. According to information available to the FAA, an estimated 32,000,000 gallons of fuel could be saved each year if Part 121 air carriers use advanced flight training simulators instead of airplanes for transition and upgrade training under Phase II. Over 73,000,000 gallons could be saved each year if the advanced simulation plan were fully implemented (Phase III). These figures are based on 1979 training flight hours utilized by air carriers. Actual fuel savings will depend on the number of Part 121 operators who elect to upgrade their simulators.

Economic Impacts. As a result of the economic and energy benefits which will result from this rule, there is no economic burden imposed on the industry, the government, or the private sector by this action. This rule offers a regulatory alternative which will result in cost savings for any operator who elects to take advantage of it. Under the plan the operator can realize more savings for each Phase of the plan it implements. Economics do, however, play an important role in an operator's decision to upgrade its simulators according to the advanced simulation plan. Basically, the operator has an opportunity to balance the cost of upgrading its simulators, including the value of the safety and training benefits of using advanced simulators, against factors such as airplane operating costs, time out of revenue service, scheduling, and maintenance problems.

Costs involved in flying the airplane vary from operator to operator depending, for example, on the type of airplane involved, the number of crewmembers who require certain types of training, revenue lost, union contracts, and training base location. Costs for upgrading a simulator also vary depending on the airplane type and the condition of the simulator before upgrade. As can be seen in the following chart, the FAA estimates that over $67 million per year could be saved by the U.S. air carriers in fuel costs and $25 million in operating costs if the industry fully implements the advanced simulation plan. In addition, economic benefits will result to the public and the operator by having additional airplanes available that would otherwise be committed to training.

Savings Per Year

Trunks, airplane type	Volume of fuel/block hours (average)	Operating cost/block hours (average)	Estimated crew training hours/year	Fuel in gallons	Fuel cost (@ $.915/gal.)[1]	Operating cost
B-707/720	1,500	$[illegible]	10,400	15,600,000	$[illegible]	$9,178,179
DC-10/30	2,267	765.44	5,200	7,000,100	6,610,100	3,980,262
B-747	3,000	1,020.79	4,210	14,000,000	15,440,762	5,841,107
L-1011	2,200	1,102.11	4,510	10,044,200	9,040,100	5,230,262
B-707/ret	1,617	460.20	5,240	5,000,100	5,004,291	1,000,100
DC-10/0	1,740	553.54	5,000	5,700,700	5,139,631	3,100,109
B-707-300	940	291.20	4,840	4,075,200	3,730,081	1,400,200
DC-8/3	800	269.30	5,640	3,200,440	2,104,270	700,000
A-300B	1,000	342.14	1,200	2,000,000	2,100,702	710,417
Total			43,010	76,270,010	67,317,000	33,340,014

Total industry operating and fuel cost savings (per year) 92,654,302

[1] Excluding crew and fuel.

[2] Based on March 1980 at $3.00 to 3.50/gal range average for domestic routes. Parallel $1.50/gal DOE quoting CAB data.

Columns 1 and 2 are weighted averages for the airplane types listed followed by a number in parentheses. That number indicates how many series of that type airplane are reported in Aircraft Operating Cost and Performance Report published by the CAB in July 1979, covering calendar years 1977 and 1978. The operating data in column 1 and 2 are CY 1978 data.

Column 3 is the product of a sample of 15 out of 56 air carriers times the factor 3.2, which represents the ratio of the population to the sample.

Environmental Impact. While it is impossible to accurately determine the environmental impact of the advanced simulation plan due to its permissive nature, it is certain that all impacts would be beneficial. Air carriers estimate that over 30,000 hours of flight training time in large turbojet aircraft were logged during 1979. This training is almost always conducted at low altitudes near major metropolitan airports. To the extent that air carriers implement the advanced simulation plan, there will be a proportionate reduction in airplane operations and related environmental effects.

It is apparent from the discussion of the benefits of this rulemaking action that the FAA has developed a program which implements Executive Order 12044 and President Carter's policy of encouraging innovative solutions to regulatory needs.

Discussion of Comments

During the comment period and its extension, the FAA received 28 comments in response to Notice 79-18.[1] These comments represented the views of individuals, airline organizations, labor organizations, simulator manufacturers, and other government agencies. Twenty-four commenters highly favored the proposal and four opposed it. Several commenters recommended changes to improve certain technical portions of Appendix H. These suggestions have been implemented in many cases. A discussion of each of the significant points raised by the commenters follows:

1. *Comment*—Too specific. By defining simulator requirements in Appendix H to Part 121, the FAA is setting up an inflexible set of requirements which are specific enough to stifle new simulator technology, yet not specific enough to fully define the type of simulator which will be acceptable for approval. Rather, the FAA should delete or dramatically reduce the Appendix H proposal and deal with specific simulator requirements in an advisory circular which can be amended more readily.

Response—It is essential not to stifle the development of new simulator technology. However, including minimum simulator requirements in an appendix to the regulation will not adversely affect technological development. Neither should the simulator requirements be specified in minute detail. Appendix H sets forth minimum requirements for simulators used under the advanced simulation plan. Minimum requirements which can be objectively measured are selected to guarantee a minimum degree of simulator sophistication and capability. While the setting of a minimum standard may result in some operators seeking merely to satisfy the minimum, the plan encourages manufacturers and operators alike to continue to strive for improvements to achieve advances

[1] The FAA received one additional comment 2½ months after the close of the comment period. Under § 11.47 of the FAR, "late filed comments are considered so far as possible without incurring expense or delay." Accordingly, the comment is considered and discussed as comment 15.

beyond the minimum. The FAA will continue to monitor the advancements in simulation and is prepared to propose amendments to the regulation if it becomes necessary in the future. The FAA is committed, however, to establishing minimum simulator requirements to ensure a minimum simulator sophistication and capability before permitting the simulator training to be substituted for training in the airplane. Detailed specifications are not included to allow technological innovation and development. Where comments showed that the Appendix H was too restrictive, the specific proposal is addressed later in this section. Setting minimum simulator requirements through the public rulemaking process ensures the widest degree of participation in the development of the requirements and provides sufficient stability in the requirements so that operators can use informed judgment in planning for and investing in simulators which may take several years to be delivered.

2. *Comment*—Motion, visual, instrument system response. Increasing the speed (response time) of the motion, visual, and instrument systems to an absolute value of 150 milliseconds as stated in simulator requirement 10 in Phase II should not be a requirement of the advanced simulation plan. The important issue is ensuring that the response of the simulator is like the airplane simulated. Further, the FAA should not require a specific test for measuring response time because of differences between simulators made by different manufacturers.

Response—The commenter is correct. The 300 and 150 millisecond response time requirements listed in Phases I and II of Appendix H are intended to be tolerances over actual airplane response times, not absolute response times. By defining specific tests in the proposal, numerous commenters were misled into thinking that they represented absolute response times rather than tolerances over airplane response times. The sections in Appendix H dealing with response times are revised to clarify that they are times for the airplane to react plus 300 or 150 milliseconds, as applicable. The tests to determine the response time are also revised to describe and clarify an acceptable test procedure, to state the required outcome of the test, and to allow the use of an equivalent test approved by the Administrator. The FAA continues to maintain the importance of considering cue correlation, that is, the relative response of motion, visual, and instrument systems, as part of the simulator programing. Therefore, Phase II simulator requirement 11 requires that the motion response occur before the visual system response, but in no case before that of the airplane or later than 150 milliseconds after the airplane would respond under the same conditions. In actual operations the airplane would have to move before the visual scene would change. This is not necessarily true in the simulator. False cues can affect training effectiveness. These response times are intended to eliminate false cues caused by a significantly slower or faster response in the simulator than in the aircraft.

3. *Comment*—Handling characteristics (Feel). While handling characteristics or "feel" are referred to in the preamble of the proposed rule, their performance comparability is not specifically addressed. Control feel dynamics should be included as criteria which an advanced simulator must meet. Further, a requirement should be included for a subjective evaluation of such characteristics by pilots experienced in the airplane type simulated. The proposed requirement for purely objective evaluations is understood and appreciated, but, the empirical experience of pilots must not be ignored.

Response—Control feel dynamics should be included in the simulator requirements and, as adopted, Appendix H includes them. Significant benefits are to be gained from a simulator evaluation conducted by a pilot who is rated in the airplane type simulated. A pilot rated in the airplane can tie together all of the objective tests results to reach a final decision on approval of the simulator. For this reason, simulator evaluations under the plan will be conducted by an FAA national simulator evaluation team which will include pilots rated in the aircraft simulated. The requirement for control feel added as simulator requirement 10 to Phase II of Appendix H is an objective test comparing the simulator to the actual airplane. During the development of Notice 79-18, the FAA was unaware of the existence of an objective test in this area. Commenters have shown that an objective test is now possible. Due to the accuracy and impartiality of objective testing, an objective test comparing the dynamic control forces of the simulator to that of the aircraft would greatly enhance the quality of control feel of advanced simulators.

4. *Comment*—Representative vs. universal programing. Representative programing should be acceptable in presenting training situations under Phases II and III of the advanced simulation plan.

Response—Representative programing involves using specific data samples to present training situations which are "representative" of selected portions of actual operational situations as compared to presenting the full or "universal" actual situation. This might be illustrated in the case of a simulation of runway contamination. Representative programing would begin with actual airplane data for dry runway stopping distances and would apply other data-gathering techniques so that an accurate yet representative wet and icy runway could be presented in simulator training. Universal programing would require airplane flight test data for every type of runway surface and contaminant to exactly duplicate any actual operational situation. Universal programing as defined here is impractical in many situations.

The advanced simulation plan goal is to achieve a *capability* to present any actual situations which may be involved in a training program today or in the future, but not a *requirement* to actually present all situations at all times. With this in mind, visual requirement 4 in Phase II and requirement 3 in Phase III of Appendix H are revised to clarify the phase of flight intended for each requirement. Operators should be aware, however, that simulators must be programed to present the actual situations required by Appendix H and by their training programs. As training programs change, simulator programing must be changed as well. By expanding simulator capabilities under the advanced simulation plan, an operator has this flexibility.

5. *Comment*—Minimum equipment list (MEL). An MEL is essential to a viable simulator training program, but the aircraft MEL is inadequate and would unnecessarily restrict the use of the simulator. A flight simulator includes many features which are not part of the real aircraft, such as an instructor's console, motion system, and visual system, but are critical for training depending on the type of training and checking being conducted. The FAA should therefore consider an MEL specifically designed for the simulator. Further, the requirement to repair failed components within 24 hours is arbitrary and unnecessary. Economics will dictate the quickest simulator repair possible since the operator will be forced to train in the airplane if the simulator is not repaired.

Response—The commenter is correct and the MEL requirements in the introduction to Appendix H are changed to allow operation under an MEL which has been approved for the simulator by

the Administrator. For standardization purposes, the MEL will include simulator components and indicate the type of training or checking that is authorized if that component is inoperative. To accomplish this, the component will be placed in one of the following categories with any remarks applicable to that component:

1. No training or checking.
2. Training in specific maneuvers.
3. Certification and checking.
4. Line Oriented Flight Training (LOFT).

The motion system is required for all training and checking, the visual system is required at each occupied pilot position, and certain components, such as those associated with thunderstorm presentations, may be required for certain portions of recurrent training but may not be required for certification checking. Components such as these should be annotated in the remarks section of the simulator MEL. However, if an instructor is occupying one of the pilot seats, the side window visual display of that seat may be inoperative. Since § 121.407 requires simulator discrepancies to be written into a daily discrepancy log, this log can be compared against the simulator MEL to show operational compliance with the MEL.

6. *Comment*—Check airman or instructor experience and training. There is no argument that experienced instructors and check airmen must be used in the advanced simulation program or that they may require special training. However, the experience and training proposed throughout Notice 79-18 should not be the only acceptable means. Rather, each operator should be allowed to submit a plan for selecting and training these personnel. This would provide flexibility so that the industry could operate within existing labor agreements and overall training programs.

Response—The comment has merit, in general, but a minimum instructor or check airman experience level and training time is being set for training conducted under the advanced simulation plan. The most sophisticated simulator can be of little value without an experienced, well-trained instructor or check airman to operate it. Because simulators will be used to totally replace the airplane in the areas allowed under a particular phase of the advanced simulation plan, the FAA wants to ensure that the instructors or check airmen involved are given a minimum amount of initial and recurrent training. Some flexibility over what was proposed in Notice 79-18, however, is warranted. Therefore, Appendix H is revised to consolidate all check airman and instructor experience and training requirements into an introductory section. The section requires each operator involved in Phase II, IIA, and III training to operate according to an advanced simulator training program approved by the Administrator which, in part, shows the following:

a. Documentation that each instructor and check airman has been employed by the certificate holder for at least 1 year in that capacity or as a pilot in command or second in command in an airplane of the group in which that pilot is instructing or checking.

b. A procedure to ensure that each instructor and check airman actively participates in either an approved regularly scheduled line flying program as a flight crewmember or an approved line observation program in the same airplane type in which that person is instructing or checking. This requirement ensures that the instructor or check airman is participating in the operator's line operations and can bring current experience to the training program.

c. A procedure to ensure that each instructor and check airman is given a minimum of 4 hours of training each year to become familiar with the operator's advanced simulation training program, or changes to it, and to emphasize their respective roles in the program. Training for simulator instructors and check airmen shall include training policies and procedures, instruction methods and techniques, operation of simulator controls (including environmental and trouble panels), limitations of the simulator, and minimum equipment required for each course of training.

7. *Comment*—First officer to captain upgrade experience requirements. The 3,000-hour flight time experience requirement set forth in Phase II of the proposal for pilots who have not previously flown the airplane type is excessive. Requiring 1,000 to 2,500 hours is more reasonable in that only 800 hours are required for pilots who have previously flown the airplane type.

Response—The comment has merit. The requirement ensures that a pilot has adequate experience to upgrade into an airplane which the pilot has never flown. The comment described above represents the views of an industry organization and a pilot professional group. Both have extensive expertise in evaluating pilot experience levels. Reconsidering the 3,000-hour proposal in light of the comment and considering the 800-hour requirement for pilots who have previously flown the same type of airplane, the FAA has concluded that the proposal should be modified. Phase II, Item 2(b)(ii), therefore, is changed to require a total of 2,500 hours of pilot experience on any two airplanes of the same group prior to upgrade under Phase II into another airplane in that group. This provides an acceptable level of safety. Pilots not meeting any portion of the eligibility requirements for upgrade under Phase II must receive initial training which must be conducted in the airplane or a Phase III simulator.

8. *Comment*—Computer capability. Many approaches exist relative to measurement of computer capabilities, making a single standard of acceptance difficult to apply to all computer manufacturers. The FAA should therefore change the reference in Phase II simulator requirement 7 of Appendix H to require simulator computer capacity, accuracy, resolution, and dynamic response to meet Phase II demands.

Response—A minimum simulator computer capacity, accuracy, resolution, and dynamic response is necessary to meet Phase II demands, especially with regard to fidelity of simulation. Setting objective criteria which ensure a certain level of computer sophistication lets the FAA ensure with more certainty that the simulator is capable of meeting varying training demands. The regulation requires "resolution *equivalent to* that of at least a 32-bit word length computer . . ." for critical aerodynamic programs. There are many different approaches which may be used to satisfy this requirement, including using 16-bit word computers with double precision software, or 24-bit computers with floating point software, for example. In this context, under Phase II of the advanced simulation plan, a computer which can show a minimum capability equivalent to or greater than a 32-bit computer is acceptable.

9. *Comment*—Built-in test procedure or equipment. Item 3 of the Phase II visual system requirements asks for a built-in test procedure. Items 5 and 6 of the Phase III simulator requirements ask for self-testing and diagnostic analysis capabilities. Do these requirements refer to procedures for testing the simulator or equipment which will automatically test the equipment? Fully automated test equipment for visual systems, if available, will not be economically feasible.

Response—These Phase II and III requirements were misunderstood by several commenters. The Phase II built-in visual test procedure was conceived to be a test procedure aided by a software model which could be entered into the visual system computer to assist the FAA and the operator in quickly

evaluating the visual system. The test procedure could consist of a test pattern or series of test patterns designed so that an inspector or maintenance technician could sit in the pilot seat and visually confirm the visual system color, Runway Visual Range (RVR), focus, intensity, level horizon, and attitude as compared with the simulator attitude indicator. There would be a software model within the computer so that special test equipment would not need to be brought into the simulator. The test procedure would be aided by a special visual system program to facilitate a quick and reasonably accurate evaluation of the visual system at each pilot's position and between pilots positions. This requirement is designed to quickly pick up visual system errors and would not replace the very involved and precise visual system tests that the operator needs to perform to align the visual system.

The Phase III simulator requirements concerning self testing and diagnostic analysis require fully automatic testing of simulator hardware and software and include a printout of simulator malfunctions as they occur. The automatic testing described in Phase III refers to the tests required for FAA initial and recurring approval and not necessarily complete testing of all software and circuitry. As simulator technology advances, this requirement will be essential for the FAA to effectively evaluate and monitor an operator's simulators. The self-testing requirement will provide more accurate data for comparing the simulator with the airplane and will allow a much more thorough evaluation in less time. This will result in benefits to the operator by reducing simulator down time. Diagnostic printouts will be in enough detail to be compared with the simulator MEL to determine the training status of the simulator each day, and will facilitate recordkeeping which will assist the FAA's surveillance of the operator's approved advanced simulation training program. The diagnostic printouts must be retained by the operator as part of the daily discrepancy log already required by § 121.407(a)(3) to show MEL compliances between recurring simulator evaluations. Appendix H, Phase III, simulator requirement 8, is revised to clarify this requirement.

10. *Comment*—Phase II visual system field of view. Some commenters favored an expanded field of view up to 80°. Others disagreed stating that experienced airmen only need a limited field of view.

Response—A field of view of at least 75° horizontal is essential to a realistic visual presentation. Such areas as roll rate, landing, circling approaches, and ground taxiing maneuvers are greatly enhanced by expanded fields of view. In visual requirement 5 of Phase II, visual gaps may occur only as they would in the airplane simulated or as required by visual system hardware. Because the visual system dramatically impacts the reality of the simulator training experience, it is important that multiple visual system displays be edge-matched and designed with appropriate visual overlap so that visual system gaps do not occur except as they would in the airplane. The size and location of different airplane windows, however, may require some shifting of visual system displays (which may be smaller than the actual window) so that, for example, the pilot can keep the runway in sight through a side window on a circling approach. Visual system hardware may therefore produce a slight gap in a certain portion of the field of view which cannot be avoided. Under these circumstances, a slight gap "required by visual system hardware" may be approved if the Administrator finds that the simulation is not adversely affected. The vertical field of view shall be 30° minimum. The visual system should be aligned so that the visual cutoff angle is accurate at the lower edge of the presentation and the upper edge of the presentation allows sufficient field of view above the horizon to see buildings and obstacles on the ground without distracting visual restrictions.

11. *Comment*—Visual effects. Visual effects such as weather presentations should be limited to specific phases of flight. Further, the Phase II visual requirement for partial obscuration of ground scenes (Item 4) should be deleted because visual systems are unable to portray curved lines and therefore clouds will be unrealistic.

Response—Requirements involving visual effects should be described according to a specific phase of flight. This point was also described in Comment No. 4. Within the context of a final approach to landing, however, the requirement for partial obscuration of ground scenes is valid. Most actual instrument approaches involve flying through scattered to broken cloud decks where the ground is visible but the runway is obscured by clouds. This results in "duck under" accidents because pilots go below minimum altitudes to see the runway, causing the airplane to contact an obstruction or land short of the runway. With the Phase II partial obscuration requirement, training designed to provide pilot experience in this area will be possible and safety will be enhanced.

While curved lines are difficult to produce in today's visual systems, a combination of trapezoidal occulting and reduced visibility could provide a realistic effect. Simulator manufacturers have assured the FAA that this requirement is not unreasonable and is within today's state-of-the-art.

12. *Comment*—Daylight visual system. There appears to be only two, or possibly three, valid user-defined requirements for a daylight visual system. They are:

a. The ability to realistically portray the difficult runway environment acquisition problem of a daytime low-visibility approach.

b. The ability to allow a cockpit lighting level in which pilots can accurately read charts and approach plates without undue diversion of attention from other flying tasks.

c. Some argue that for inexperienced pilots the daylight environment is less threatening and allows for more rapid orientation during visual approaches and landings. It is presumably for this reason that daylight visual systems are required by the proposed rule for initial trainees.

Due to the voluminous technical specifications required to define an adequate system, the definition of a daylight visual system should be in general operational terms rather than technical terms. The proposed rules sets forth only a few discrete technical specifications, and thus inadequately describes a proper daylight visual system. Such an approach also allows a situation in which literal compliance with the rule might well produce, operationally, a totally inadequate daylight visual system. Additionally, several of the specifications proposed (for example, surfaces and edges) discriminate against competent conceptual approaches to daylight visual simulation by certain manufacturers, and preclude technological advancement in a promising direction which may make the number of surfaces and edges meaningless. Other specifications in Notice 79-18 should not be assigned absolute values in the absence of known values for the many other variables in the daylight system. In fact, a requirement to literally meet only a few specifications could well result in a degradation of the dusk and night presentations which now enjoy great acceptance by the user pilots.

Response—Since the majority of air carrier flying time is during daylight hours and for the reasons cited above, the FAA is committed to encouraging

advances in the state-of-the-art in visual systems by requiring a daylight scene in the Phase III visual requirement 1. As described in Comment No. 1, objective simulator and visual system requirements are selected to guarantee a minimum degree of system sophistication and capability. Once the objective requirements are met, the visual system's ability to present the required visual effects will be evaluated subjectively. The system must, however, meet the objective criteria listed in Phase III to be considered a daylight system. Detailed specifications are not included to allow technological development. As technology progresses, any daylight visual system which can show equivalent capabilities in the objective areas described in Phase III will be considered for subjective approval.

In this regard, the requirement for 1,000 surfaces or 4,000 edges is amended to include the phrase "comparable in detail to that produced by 4,000 edges. . . ." The 1,000 surfaces or 4,000 edges are included to establish a minimum scene content capability. When technology progresses to where a specific number of edges and surfaces are unnecessary, a perceived scene content at least comparable in detail will be acceptable.

This scene content should be designed so that the airport and major landmarks can be recognized from 5 miles from the airport with detail unnoticably shifting to the runway environment as the airplane approaches landing. Detail on final approach should assist the pilot to visually assess the airplane sink rate and provide cues to improve depth perception. The total daylight cockpit environment requirement in visual requirement 1 is also revised to include a provision that it must at least represent the amount of light in the cockpit on an overcast day. This has been done to clear up a misunderstanding that sunlight needs to shine in the window. The criteria included in the rule describe the lighting effect of an overcast day. This amount of light allows a pilot to read navigation charts without other cockpit lighting and allows an instructor to more easily observe the student's actions during simulator training.

13. *Comment*—Loss of Phase IIA training. The phrase "Any simulator not upgraded according to the operator's approved simulator upgrade program will void the plan resulting in loss of all Phase IIA Training" in the introduction to Phase IIA is too encompassing and would end Phase IIA training on one aircraft if a simulator for a different aircraft were not upgraded as proposed in the plan. It should be changed to read: "Any simulator not upgraded according to the operator's approved simulator plan will result in loss of Phase IIA training for that aircraft type."

Response—Phase IIA is an interim program designed to provide economic incentive for operators upgrading a large segment of their simulator fleet. All simulators entered into the plan must be upgraded according to the plan. Plans should be realistic and be based on firm commitments. One objective of the advanced simulation plan is to issue the Part 61 airline transport pilot (ATP) certificate upon successful completion of the appropriate simulator check. However, a second objective is to upgrade operators' simulator capabilities to present realistic training in various abnormal and weather flight conditions which may be encountered during line operations. If an operator fails to meet its commitment to the approved plan, it has achieved the economic benefit expressed in the first objective because it has avoided the airplane flights. By not upgrading the simulator, however, it has failed to provide a simulator capable of achieving the second objective of the plan. Both objectives are essential to the plan.

14. *Comment*—Six-axis motion systems. Specifying a six-axis motion system could hamper advanced research and development of a superior method of providing motion cues. It is therefore recommended that this requirement be changed to read: "A system which provides motion cues equal to or better than those provided by a six-axis freedom of motion system."

Response—While the FAA is unaware of any technology more advanced than the six-axis system, a new system could be acceptable if better technology becomes available. The Phase II simulator requirement 4 is revised as recommended. However, the FAA will not approve a visual system instead of a motion system because visual systems are incapable of providing motion onset cues.

15. *Comment*—Psychological considerations. One important factor has been overlooked in the study contained in the NPRM; that is, the psychological considerations of flight. An atmosphere of complacency is prevalent while operating a simulator irrespective of its sophistication. This psychological phenomenon is present because of the knowledge that, regardless of what mistakes are committed, the consequences of actions are negated because a simulator cannot crash.

Response—In point of fact, almost the exact opposite is true. Pilots do not fly airplanes out of a sense of fear. Further, actual airplane training flights are not conducted in adverse weather conditions. A flight instructor would not intentionally allow a trainee to get the airplane into a position which would jeopardize safety. Simulator training on the other hand is designed to facilitate training in varying environmental conditions and to let the trainee learn from mistakes. If a pilot makes a tragic mistake in a simulator, the simulator will dramatically simulate a crash and there is no doubt as to who made the mistake. The pilot's self esteem, peer pressure, and the pressure of being observed by one's employer and possibly the FAA can exceed the psychological pressure of flying the airplane. Appendix H and § 121.433 will continue to require line operating experience which ensures that each new airline captain is supervised by a company check pilot who is serving as pilot in command on the new captain's first flights on the line.

16. *Comment*—The plan is unfair and unsafe. One commenter opposes the proposed advanced simulation plan because the plan is deficient in the following respects: (1) The plan allows for the increased use of simulators without showing that it will not decrease safety; (2) The plan phases in the use of simulators too fast relative to existing and potential simulator technology; and (3) The plan fails to take into account the ultimate limits on the use of simulators.

Response—The main thrust of the advanced simulation plan is to improve safety by encouraging operators to upgrade their simulators and to produce better-trained flightcrews. In addition to the lengthy discussion of safety benefits in this preamble and Notice 79-18, the notice (see 44 FR 63552, column 1; November 13, 1979) references two FAA operational studies which helped to show that existing upgrade and transition training requirements can be accomplished in simulators which are not as sophisticated as those required in the advance simulation plan. Further, NASA has dramatically illustrated the ability of a pilot to successfully accomplish total training in a simulator as evidenced by its putting several men on the moon without having flown in the craft before. Commenters from all sides of the issue, including air carriers, pilot organizations, airline passenger organizations, and the National Transportation Safety Board, support the advanced simulation plan. This

commenter provided no data to show how safety would be compromised.

With regard to point 2, simulators are only a portion of a total training program which is set be approved for the operator. With regard to the simulator, the three phases of the advanced simulation plan are designed to provide incentives to upgrade the simulators to a level which results in the safety benefits described under point 1. Simulator technology for Phase II is currently available to the industry and Phase III will be available within 5 years. By presenting a complete plan for simulator upgrade, it will be advantageous to airplane operators to introduce this technology into their training programs. If a complete plan is not presented, or if the timing assessed in the plan is altered, the training improvements needed to provide for safer flight operations will not be achieved. Point 3 was discussed previously as Comment 15.

In developing this plan, the FAA gave full consideration to section 601(b) of the Federal Aviation Act of 1958, which states that the "Administrator shall give full consideration to the duty resting upon air carriers to perform their services with the highest possible degree of safety in the public interest . . ." The rule is consistent with that statutory requirement.

Points of Clarification

In addition to the major points raised by commenters, numerous points of clarification were raised concerning the interpretation of technical requirements. Thus, Appendix H is amended in several areas to clarify wording proposed in Notice 79-18. These points include consolidating all requirements common to several phases of the plan into the introduction of Appendix H and making the following minor changes to wording used in the Notice:

1. Phase II. "Training and Checking Permitted," is amended to show that transition training is for all pilot positions, not just pilot in command.

2. Phase II. Simulator Requirement 7, is amended to delete "and Phase III Demands" which is inappropriate in Phase II.

3. Phase II. Visual Requirement 1, is amended to clarify that at least three specific airport representations must be included in the simulator but that all airport representations need not be specific. Also "a capability of" ten levels of occulting is added to this requirement to show that each visual scene need not have ten levels if it is inappropriate.

4. Phase II. Visual Requirement 5, is amended to state that both visual systems shall "be able to" be operated. This clarifies the intent that pilot visual systems may be included in the MEL, but when operative, must work in both pilot positions.

The Amendment

Accordingly, Parts 61 and 121 of the Federal Aviation Regulations (14 CFR Parts 61 and 121) are amended as follows, effective July 30, 1980.

PART 61—CERTIFICATION: PILOTS AND FLIGHT INSTRUCTORS

1. By revising § 61.157 by adding a new paragraph (e) to read as follows:

§ 61.157 Airplane rating: Aeronautical skill.

* * * * *

(e) An approved simulator may be used instead of the airplane to satisfy the in-flight requirements of Appendix A of this Part, if the simulator—

(1) Is approved under § 121.407 of this chapter and meets the appropriate simulator requirements of Appendix H of Part 121, and

(2) Is used as part of an approved program that meets the training requirements of § 121.424 (a) and (c) and Appendix H of Part 121 of this chapter.

PART 121—CERTIFICATION AND OPERATIONS: DOMESTIC, FLAG, AND SUPPLEMENTAL AIR CARRIERS AND COMMERCIAL OPERATORS OF LARGE AIRCRAFT

2. By revising § 121.407 by adding a new paragraph (c) to read as follows:

§ 121.407 Training program: Approval of airplane simulators and other training devices.

* * * * *

(c) An airplane simulator may be used instead of the airplane to satisfy the in-flight requirements of §§ 121.439 and 121.441 and Appendices E and F of this Part, if the simulator—

(1) Is approved under this section and meets the appropriate simulator requirements of Appendix H of this Part; and

(2) Is used as part of an approved program that meets the training requirements of §121.424 (a) and (c) and Appendix H of this Part.

3. By adding a new Appendix H to Part 121 which reads as follows:

Appendix H—Advanced Simulation Plan

This Appendix provides guidelines and a means for achieving flightcrew training on advanced airplane simulators. This plan for achieving the goal of advanced simulation consists of three major phases and an interim phase to facilitate the plan's implementation. The three-phase plan is to provide standards for a progressive upgrade of airplane simulators so that the total scope of flightcrew training can be enhanced. Each phase builds on the preceding phase so that the final advanced simulation phase includes all the requirements of preceding phases. This Appendix describes the simulator and visual system requirements which must be achieved to obtain approval of certain types of training in the simulator. The requirements in this Appendix are in addition to the simulator approval requirements in § 121.407. Each simulator which is used under this Appendix must be approved as a Phase I, II, or III simulator, as appropriate.

To obtain FAA approval of the simulator for a specific phase, the following must be demonstrated to the satisfaction of the Administrator:

1. Documented proof of compliance with the appropriate simulator, visual system, and additional training requirements of this Appendix for the phase for which approval is requested and preceding phases, if appropriate.

2. An evaluation of the simulator to ensure that its ground, flight, and landing performance matches the type of airplane simulated (Phase I Approval Tests).

3. An evaluation of the appropriate simulator and visual system requirements of the phase for which approval is requested and preceding phases, if appropriate.

Changes to Simulator Programing:

While a need exists for some flexibility in making changes in the software program, strict scrutiny of these changes is essential to ensure that the simulator retains its ability to duplicate the airplane's flight and ground characteristics. Therefore, the following procedure must be followed to allow these changes without affecting the approval of an Appendix H simulator:

1. Twenty-one calendar days before making changes to the software program which might impact flight or ground dynamics of an Appendix H simulator, a complete list of these planned changes, including dynamics related to the motion and visual systems, must be provided in writing to the FAA office responsible for conducting the recurrent evaluation of that simulator.

2. If the FAA does not object to the planned change within 21 calendar days, the operator may make the change.

3. Changes which might affect the approved simulator Phase I test guide must be tested by the operator in the simulator to determine the impact of the change before submission to the FAA.

4. Software changes actually installed must be summarized and provided to the FAA. When the operator's test shows a difference in simulator performance due to a change, an amended copy of the test guide page which includes the new simulator test results will also be provided to update the FAA's copy of the test guide.

5. The FAA may examine supporting data or flight check the simulator, or both, to ensure that the aerodynamic quality of the simulator has not been degraded by any change in software programing.

6. All requests for changes are evaluated on the basis of the same criteria used in the initial approval of the simulator for Phase I, II, or III.

Simulator Minimum Equipment List (MEL):

Because of the strict tolerances and other approval requirements of Appendix H simulators, the simulator can provide realistic training with certain nonessential items inoperative. Therefore, an operator may operate its simulator under an MEL which has been approved by the Administrator for that simulator. The MEL includes simulator components and indicates the type of training or checking that is authorized if the component becomes inoperative. To accomplish this, the component is placed in one of the following categories along with any remarks applicable to the component's use in the training program:

1. No training or checking.
2. Training in specific maneuvers.
3. Certification and checking.
4. Line Oriented Flight Training (LOFT).

Advanced Simulation Training Program:

For an operator to conduct Phase II, IIA, or III training under this Appendix all required simulator instruction and checks must be conducted under an advanced simulation training program must also ensure that all instructors and check airmen used in Appendix H training and checking are highly qualified to provide the training required in the training program. The advanced simulation training program shall include the following:

1. The operator's initial, transition, upgrade, and recurrent simulator training programs and its procedures for re-establishing recency of experience in the simulator.

2. How the training program will integrate Phase I, II, and III simulators with other simulators and training devices to maximize the total training, checking, and certification functions.

3. Documentation that each instructor and check airman has been employed by the certificate holder for at least 1 year in that capacity or as a pilot in command or second in command in an airplane of the group in which that pilot is instructing or checking.

4. A procedure to ensure that each instructor and check airman actively participates in either an approved regularly scheduled line flying program as a flight crewmember or an approved line observation program in the same airplane type for which that person is instructing or checking.

5. A procedure to ensure that each instructor and check airman is given a minimum of 4 hours of training each year to become familiar with the operator's advanced simulation training program, or changes to it, and to emphasize their respective roles in the program. Training for simulator instructors and check airmen shall include training policies and procedures, instruction methods and techniques, operation of simulator controls (including environmental and trouble panels), limitations of the simulator, and minimum equipment required for each course of training.

6. A special Line Oriented Flight Training (LOFT) program to facilitate the transition from the simulator to line flying. This LOFT program consists of at least a 4-hour course of training for each flightcrew. It also contains at least two representative flight segments of the operator's route. One of the flight segments contains strictly normal operating procedures from push back at one airport to arrival at another. Another flight segment contains training in appropriate abnormal and emergency flight operations.

7. For operators training under Phase IIA, the additional training requirements of that phase.

Phase I

Training and Checking Permitted

1. Regency of experience (§ 121.439).
2. Night takeoffs and landings (Part 121, Appendix E).
3. Landings in a proficiency check without the landing on the line requirements (§ 121.441).

Simulator Requirements

1. Aerodynamic programing to include:

a. Ground effect—for example, roundout, flare, and touchdown. This requires data on lift, drag, and pitching moment in ground effect.

b. Ground reaction—Reaction of the airplane upon contact with the runway during landing to include strut deflections, tire friction, and side forces.

c. Ground handling characteristics—steering inputs to include crosswind, braking, thrust reversing, deceleration, and turning radius.

2. Minimum of 3-axis freedom of motion systems.

3. Phase I landing maneuver test guide to verify simulator data with actual airplane flight test data, and provide simulator performance tests for Phase I initial approval.

4. Multichannel recorders capable of recording Phase I performance tests.

Visual Requirements

1. Visual system compatibility with aerodynamic programing.

2. Visual system response time from pilot control input to visual system output shall not exceed 300 milliseconds more than the movement of the airplane to a similar input. Visual system response time is defined as the completion of the visual display scan of the first video field containing different information resulting from an abrupt control input.

3. A means of recording the visual response time for comparison with airplane data.

4. Visual cues to assess sink rate and depth perception during landings.

5. Visual scene to instrument correlation to preclude perceptible lags.

Phase II

Training and Checking Permitted

1. For all pilots, transition training between airplanes in the same group, and for a pilot in command the certification check required by § 61.157 of this chapter.

2. Upgrade to pilot-in-command training and the certification check when—

a. The pilot—(i) Has previously qualified as second in command in the equipment to which the pilot is upgrading;

(ii) Has at least 500 hours of actual flight time while serving as second in command for the operator in an airplane in the same group; and

(iii) Is currently serving as second in command with that operator in an airplane in this same group; or

b. The pilot is employed by an airplane operator and—(i) is currently serving as second in command with that operator in an airplane of the same group;

(ii) has a minimum of 2,500 flight hours as second in command in airplanes of the same group with that operator; and

(iii) has served as second in command on at least two airplanes of the same group with that operator.

Pilots qualifying under paragraph 2.b. of this paragraph may upgrade to another airplane in that group in which that pilot has not been previously qualified.

Simulator Requirements

1. Representative crosswind and three-dimensional windshear dynamics based on airplane related data.

2. Representative stopping and directional control forces for at least the following runway conditions based on airplane related data:

a. Dry.
b. Wet.
c. Icy.
d. Patchy wet.
e. Patchy icy.
f. Wet on rubber residue in touchdown zone.

3. Representative brake and tire failure dynamics (including antiskid) and decreased brake efficiency due to high brake temperatures based on airplane related data.

4. A motion system which provides motion cues equal to or better than those provided by a six-axis freedom of motion system.

5. Operational principal navigation systems, including electronic flight instrument systems, INS, and OMEGA, if applicable.

6. Means for quickly and effectively testing simulator programing and hardware.

7. Expanded simulator computer capacity, accuracy, resolution, and dynamic response to meet Phase II demands. Resolution equivalent to that of at least a 32-bit word length computer is required for critical aerodynamic programs.

8. Timely permanent update of simulator hardware and programing subsequent to airplane modification.

9. Sound of precipitation and significant airplane noises perceptible to the pilot during normal operations and the sound of a crash when the simulator is landed in excess of landing gear limitations.

10. Aircraft control feel dynamics shall duplicate the airplane simulated. This shall be determined by comparing a recording of the control feel dynamics of the simulator to airplane measurements in the takeoff, cruise, and landing configuration.

11. Relative responses of the motion system, visual system, and cockpit instruments shall be coupled closely to provide integrated sensory cues. These systems shall respond to abrupt pitch, roll, and yaw inputs at the pilot's position within 150 milliseconds of the time, but not before the time, when the airplane would respond under the same conditions. Visual scene changes from steady state disturbance shall not occur before the resultant motion onset but within the system dynamic response tolerance of 150 milliseconds. The test to determine compliance with these requirements shall include simultaneously recording the analog output from the pilot's control column and rudders, the output from an accelerometer attached to the motion system platform located at an acceptable location near the pilots' seats, the output signal to the visual system display (including visual system analog delays), and the output signal to the pilot's attitude indicator or an equivalent test approved by the Administrator. The test results in a comparison of a recording of the simulator's response to actual airplane response data in the takeoff, cruise, and landing configuration.

Visual Requirements

1. Dusk and night visual scenes with at least three specific airport representations, including a capability of at least 10 levels of occulting, general terrain characteristics, and significant landmarks.

2. Radio navigation aids properly oriented to the airport runway layout.

3. Test procedures to quickly confirm visual system color, RVR, focus, intensity, level horizon, and attitude as compared to the simulator attitude indicator.

4. For the approach and landing phase of flight, at and below an altitude of 2,000 feet height above the airport (HAA) and within a radius of 10 miles from the airport, weather representations including the following:

a. Variable cloud density.

b. Partial obscuration of ground scenes; that is, the effect of a scattered to broken cloud deck.

c. Gradual break out.

d. Patchy fog.

e. The effect of fog on airport lighting.

f. Category II and III weather conditions.

5. Continuous minimum visual field of view of 75° horizontal and 30° vertical per pilot seat. Visual gaps shall occur only as they would in the airplane simulated or as required by visual system hardware. Both pilot seat visual systems shall be able to be operated simultaneously.

6. Capability to present ground and air hazards such as another airplane crossing the active runway or converging airborne traffic.

Phase IIA

Interim Simulator Upgrade Plan for Part 121 Operators

Under Phase IIA, any Part 121 operator may conduct Phase II training for 3½ years from the date it was approved for Phase I in a simulator approved for the landing maneuver under Phase I. The operator must meet the additional requirements set forth below and submit a plan acceptable to the Administrator to upgrade its simulator(s) to meet Phase II standards. For a carrier's upgrade plan to be acceptable, it must—

1. Be submitted to the FAA before July 30, 1981.

2. Show which simulators will be upgraded to Phase I requirements and their projected upgrade dates;

3. Show that these simulators will meet Phase I requirements before January 30, 1983.

4. Show that at least 80 percent of the operator's simulators for those airplane types for which Phase IIA training is expected will be upgraded to, or be replaced with, simulators which meet Phase II or III requirements and—

a. Show which simulators will be upgraded to, or replaced with, simulators which meet phase II or III requirements; and

b. Show that each of these simulators will meet Phase II or III requirements within 3½ years after the date it is approved for Phase I; and

5. Include an advanced simulation training program which meets the requirements of this appendix.

To conduct Phase IIA training in a Phase I simulator, all required simulator instruction and checks must be conducted in a simulator as part of an advanced simulator training program approved for the operator, including the additional training requirements of this phase.

Phase IIA interim approval ends for each Phase I simulator listed in the operator's approved plan 3½ years after that simulator is approved for Phase IIA training. Approval of the plan is withdrawn if any simulator is not upgraded according to the operator's approved simulator upgrade plan. This results in the loss of all Phase IIA training for that operator. Extension of Phase IIA training will not be considered.

Training and checking permitted: Same as Phase II.

Simulator requirements: Same as Phase I.

Visual requirements: Same as Phase I.

Additional training requirements:

1. In addition to the simulator training and the simulator certification and

212

proficiency check, and before the line operating experience training, participating flight crewmembers must complete a 4-hour Line Oriented Flight Training Course in the simulator to prepare them to perform line duties.

2. Each participating pilot in command must be given operating experience in the airplane to include 5 landings and 25 flight hours, and each second in command must be given 3 landings and 15 flight hours of line experience at his or her crew station under the supervision of a check airman who meets the qualifications of paragraph 3 and who is seated in the other pilot's position.

3. Each participating line check airman must be given an approved 4-hour training course to familiarize him or her with the Phase IIA program and to emphasize his or her role in the program. He or she shall also be qualified to provide both line and proficiency checks or be a line check airman who has successfully completed an approved simulator check airman course.

Phase III

Training and Checking Permitted

Except for the requirements listed in the next sentence, all pilot flight training and checking required by this Part and the certification check requirements of § 61.157 and Appendix A of Part 61 of this chapter. The line check required by § 121.440, the static airplane requirements of Appendix E of this Part, and the operating experience requirements of § 121.434 must still be performed in the airplane.

Simulator Requirements

1. Characteristic buffet motions that result from operation of the airplane (for example, high-speed buffet, extended landing gear, flaps, nose-wheel scuffing, stall) which can be sensed at the flight deck. The simulator must be programed and instrumented in such a manner that the characteristic buffet modes can be measured and compared to airplane data. Airplane data are also required to define flight deck motions when the airplane is subjected to atmospheric disturbances such as rough air and cobblestone turbulence. General purpose disturbance models that approximate demonstrable flight test data are acceptable.

2. Aerodynamic modeling for aircraft for which an original type certificate is issued after June 1, 1980, including low-altitude, level-flight ground effect, mach effect at high altitude, effects of airframe icing, normal and reverse dynamic thrust effect on control surfaces, aeroelastic representations, and representations of nonlinearities due to side slip based on airplane flight test data provided by the manufacturer.

3. Realistic amplitude and frequency of cockpit noises and sounds, including precipitation static and engine and airframe sounds. The sounds shall be coordinated with the weather representations required in visual requirement No. 3.

4. Self-testing for simulator hardware and programing to determine compliance with Phase I, II, and III simulator requirements.

5. Diagnostic analysis printout of simulator malfunctions sufficient to determine MEL compliance. These printouts shall be retained by the operator between recurring FAA simulator evaluations as part of the daily discrepancy log required under § 121.407(a)(3).

Visual Requirements

1. Daylight, dusk, and night visual scenes with sufficient scene content to recognize a specific airport, the terrain, and major landmarks around that airport and to successfully accomplish a visual landing. The daylight visual scene must be part of a total daylight cockpit environment which at least represents the amount of light in the cockpit on an overcast day. For the purpose of this rule, daylight visual system is defined as a visual system capable of producing, as a minimum, full color presentations, scene content comparable in detail to that produced by 4,000 edges or 1,000 surfaces for daylight and 4,000 light points for night and dusk scenes, 6-foot lamberts of light at the pilot's eye (highlight brightness), 3-arc minutes resolution for the field of view at the pilot's eye, and a display which is free of apparent quantization and other distracting visual effects while the simulator is in motion. The simulation of cockpit ambient lighting shall be dynamically consistent with the visual scene displayed. For daylight scenes, such ambient lighting shall neither "washout" the displayed visual scene nor fall below 5-foot lamberts of light as reflected from an approach plate at knee height at the pilot's station and/or 3-foot lamberts of light as reflected from the pilot's face.

2. Visual scenes portraying representative physical relationships which are known to cause landing illusions in some pilots, including short runway, landing over water, runway gradient, visual topographic features, and rising terrain.

3. Special weather representations which include the sound, visual, and motion effects of entering light, medium, and heavy precipitation near a thunderstorm on takeoff, approach, and landings at and below an altitude of 2,000 feet HAA and within a radius of 10 miles from the airport.

4. Phase II visual requirements in daylight as well as dusk and night representations.

5. Wet and, if appropriate for the operator, snow-covered runway representations, including runway lighting effects.

6. Realistic color and directionality of airport lighting.

7. Weather radar presentations in aircraft where radar information is presented on the pilot's navigation instruments.

(Secs. 313, 601, 603, 604, Federal Aviation Act of 1958, as amended (49 U.S.C. 1354, 1421, 1423, 1424); sec. 6(c), Department of Transportation Act (49 U.S.C. 1655(c)))

Note.—The FAA has determined that this document involves a regulation which is not significant under Executive Order 12044 as implemented by DOT Regulatory Policies and Procedures (44 FR 11034, February 26, 1979). A copy of the final regulatory evaluation prepared for this action is contained in the regulatory docket. A copy of it may be obtained by contacting the person identified above under the caption "For Further Information Contact."

Issued in Washington, D.C., on June 24, 1980.

Quentin S. Taylor,

Deputy Administrator.

[FR Doc. 80-19868 Filed 6-27-80; 8:45 am]

[BILLING CODE 4910-13-M]

Appendix F

Proficiency Check Requirements

The maneuvers and procedures required by section 121.441 for pilot proficiency checks are set forth in this appendix and must be performed inflight except to the extent that certain maneuvers and procedures may be performed in an airplane simulator with a visual system (visual simulator), an airplane simulator without a visual system (non-visual simulator), or a training device as indicated by the appropriate symbol in the respective column opposite the maneuver or procedure.

Whenever a maneuver or procedure is authorized to be performed in a non-visual simulator, it may also be performed in a visual simulator; when authorized in a training device, it may be performed in a visual or non-visual simulator.

For the purpose of this appendix, the following symbols mean—

P = Pilot in Command

B = Both Pilot in Command and Second in Command

* = A symbol and asterisk (B*) indicates that a particular condition is specified in the maneuvers and procedures column.

= When a maneuver is preceded by this symbol # it indicates the maneuver may be required in the airplane at the discretion of the person conducting the check.

Throughout the maneuvers prescribed in this appendix, good judgment commensurate with a high level of safety must be demonstrated. In determining whether such judgment has been shown, the person conducting the check considers adherence to approved procedures, actions based on analysis of situations for which there is no prescribed procedure or recommended practice, and qualities of prudence and care in selecting a course of action.

See tables on following pages.

Maneuvers/Procedures	Required		Permitted			
	Simulated Instrument Conditions	Inflight	Visual Simulator	Non-Visual Simulator	Training Device	Waiver Provisions of §121.441(d)
The procedures and maneuvers set forth in this appendix must be performed in a manner that satisfactorily demonstrates knowledge and skill with respect to— (1) The airplane, its systems and components; (2) Proper control of airspeed, configuration, direction, altitude, and attitude in accordance with procedures and limitations contained in the approved Airplane Flight Manual, the certificate holder's operations manual, check lists, or other approved material appropriate to the airplane type; and (3) Compliance with approach, ATC, or other applicable procedures.						
I. Preflight						
(a) Equipment examination (oral or written). As part of the practical test the equipment examination must be closely coordinated with, and related to, the flight maneuvers portion but may not be given during the flight maneuvers portion. The equipment examination must cover— (1) Subjects requiring a practical knowledge of the airplane, its powerplants, systems, components, operational, and performance factors; (2) Normal, abnormal, and emergency procedures, and the operations and limitations relating thereto; and (3) The appropriate provisions of the approved Airplane Flight Manual. The person conducting the check may accept, as equal to this equipment test, an equipment test given to the pilot in the certificate holder's ground school within the preceding six calendar months.	.....		.....	.....	B	.....
(b) Preflight inspection. The pilot must— (1) Conduct an actual visual inspection of the exterior and interior of the airplane, locating each item and explaining briefly the purpose for inspecting it; and (2) Demonstrate the use of the prestart check list, appropriate control system checks, starting procedures, radio and electronic equipment checks, and the selection of proper navigation and communications radio facilities and frequencies prior to flight. Except for flight checks required by §121.424 (d) (2), an approved pictorial means that realistically portrays the location and detail of preflight inspection items and provides for the portrayal of abnormal conditions may be substituted for the preflight inspection. If a flight engineer is a required flight crewmember for the particular type airplane, the visual inspection may be waived under §121.441 (d).	.....		.....	.....	B	B*
(c) Taxiing. This maneuver includes taxiing (in the case of a second in command proficiency check to the extent practical from the second in command crew position), sailing, or docking procedures in compliance with instructions issued by the appropriate traffic control authority or by the person conducting the checks.	.....	P	.....	.....	.....	.....

Maneuvers/Procedures	Required		Permitted			
	Simulated Instrument Conditions	Inflight	Visual Simulator	Non-Visual Simulator	Training Device	Waiver Provisions of §121.441(f)
(d) Powerplant checks. As appropriate to the airplane type.				B		
II. Takeoffs.						
(a) Normal. One normal takeoff which, for the purpose of this maneuver, begins when the airplane is taxied into position on the runway to be used.		B*				
(b) Instrument. One takeoff with instrument conditions simulated at or before reaching an altitude of 100 feet above the airport elevation.	B		B*			
(c) Cross wind. One cross wind takeoff, if practicable, under the existing meteorological, airport, and traffic conditions.		B*				
Requirements (a) and (c) may be combined, and requirements (a), (b), and (c) may be combined if (b) is performed inflight.						
a(d) Powerplant failure. One takeoff with a simulated failure of the most critical powerplant—			B*			
(1) At a point after V_1 and before V_2 that in the judgment of the person conducting the check is appropriate to the airplane type under the prevailing conditions; or						
(2) At a point as close as possible after V_1 when V_1 and V_2 or V_1 and V_r are identical; or						
(3) At the appropriate speed for nontransport category airplanes.						
In an airplane group with all fixed-high-powered engines this maneuver may be performed in a nonvisual simulator.						
(e) Rejected. A rejected takeoff may be performed in an airplane during a normal takeoff run after reaching a reasonable speed determined by giving due consideration to aircraft characteristics, runway length, surface conditions, wind direction and velocity, brake heat energy, and any other pertinent factors that may adversely affect safety of the airplane.				B*		B
III. Instrument Procedures.						
(a) Area departure and area arrival. During each of these maneuvers the applicant must—	B			B		B*
(1) Adhere to actual or simulated ATC clearances (including assigned radials); and						
(2) Properly use available navigation facilities.						
Either area arrival or area departure, but not both, may be waived under § 121.441(f).						
(b) Holding. This maneuver includes entering, maintaining, and leaving holding patterns. It may be performed in connection with either area departure or area arrival.	B			B		B
(c) ILS and other instrument approaches. There must be the following:						
(1) At least one normal ILS approach	B		B			
(2) At least one manually controlled ILS approach with a simulated failure one powerplant. The simulated failure should occur before initiating the final approach course and must continue to touchdown or through the missed approach procedure.	B	B				

Maneuvers/Procedures	Required		Permitted			
	Simulated Instrument Conditions	Inflight	Visual Simulator	Non-Visual Simulator	Training Device	Waiver Provisions of §121.441(d)
(3) At least one nonprecision approach procedure that is representative of the nonprecision approach procedures that the certificate holder is likely to use.	B		B			
(4) Demonstration of at least one nonprecision approach procedure on a letdown aid other than the approach procedure performed under subparagraph (3) of this paragraph that the certificate holder is approved to use. If performed in a training device, the procedures must be observed by a check pilot or an approved instructor.	B				B	
Each instrument approach must be performed according to any procedures and limitations approved for the approach facility used. The instrument approach begins when the airplane is over the initial approach fix for the approach procedure being used (or turned over to the final approach controller in the case of GCA approach) and ends when the airplane touches down on the runway or when transition to a missed approach configuration is completed. Instrument conditions need not be simulated below 100 feet above touchdown zone elevation.						
(d) Circling approaches. If the certificate holder is approved for circling minimums below 1000-3, at least one circling approach must be made under the following conditions—			B*			B*
(1) The portion of the approach to the authorized minimum circling approach altitude must be made under simulated instrument conditions.	B					
(2) The approach must be made to the authorized minimum circling approach altitude followed by a change in heading and the necessary maneuvering (by visual reference) to maintain a flight path that permits a normal landing on a runway at least 90 degrees from the final approach course of the simulated instrument portion of the approach.						
(3) The circling approach must be performed without excessive maneuvering, and without exceeding the normal operating limits of the airplane. The angle of bank should not exceed 30 degrees.						
If local conditions beyond the control of the pilot prohibit the maneuver or prevent it from being performed as required, it may be waived as provided in § 121.441(d). Provided, however, that the maneuver may not be waived under this provision for two successive proficiency checks. The circling approach maneuver is not required for a second-in-command if the certificate holder's manual prohibits a second-in-command from performing a circling approach in operations under this Part.						
(e) Missed approach.						
(1) Each pilot must perform at least one missed approach from an ILS approach.			B*			
(2) Each pilot-in-command must perform at least one additional missed approach.			P*			

Maneuvers/Procedures	Required		Permitted			
	Simulated Instrument Conditions	Inflight	Visual Simulator	Non-Visual Simulator	Training Device	Waiver Provisions of §121.441(d)
A complete approved missed approach procedure must be accomplished at least once. At the discretion of the person conducting the check, a simulated powerplant failure may be required during any of the missed approaches. These maneuvers may be performed either independently or in conjunction with maneuvers required under Sections III or V of this appendix. At least one missed approach must be performed in flight.						
IV. Inflight Maneuvers.						
(a) Steep turns. At least one steep turn in each direction must be performed. Each steep turn must involve a bank angle of 45 degrees with a heading change of at least 180° but not more than 360°	P	.....	.....	P	.....	P
(b) Approaches to stalls. For the purpose of this maneuver the required approach to a stall is reached when there is a perceptible buffet or other response to the initial stall entry. Except as provided below there must be at least three approaches to stalls as follows:	B	.....	.....	B	.....	B*
(1) One must be in the takeoff configuration (except where the airplane uses only a zero-flap takeoff configuration).						
(2) One in a clean configuration.						
(3) One in a landing configuration.						
At the discretion of the person conducting the check, one approach to a stall must be performed in one of the above configurations while in a turn with the bank angle between 15 and 30 degrees. Two out of the three approaches required by this paragraph may be waived. If the certificate holder is authorized to dispatch or flight release the airplane with a stall warning device inoperative the device may not be used during this maneuver.						
(c) Specific flight characteristics. Recovery from specific flight characteristics that are peculiar to the airplane type	.....	.....	.....	B	.....	B
(d) Powerplant failures. In addition to specific requirements for maneuvers with simulated powerplant failures, the person conducting the check may require a simulated powerplant failure at any time during the check.	.....	.....	.....	B	.....	.....
V. Landings and Approaches to Landings.						
Notwithstanding the authorizations for combining and waiving maneuvers and for the use of a simulator, at least two actual landings (one to a full stop) must be made for all pilot-in-command and initial second-in-command proficiency checks. Landings, and approaches to landings must include the following, but more than one type may be combined where appropriate:						
(a) Normal landing	.....	B	.....	.....	.....	.....
(b) Landing in sequence from an ILS instrument approach except that if circumstances beyond the control of the pilot	.....	B*	.....	.....	.....	.....

Maneuvers/Procedures	Required		Permitted			
	Simulated Instrument Conditions	Inflight	Visual Simulator	Non-Visual Simulator	Training Device	Waiver Provisions of §121.441(d)
prevent an actual landing, the person conducting the check may accept an approach to a point where in his judgment a landing to a full stop could have been made.						
(c) Cross wind landing, if practical under existing meteorological, airport, and traffic conditions.		B*				
[(d) Maneuvering to a landing with simulated powerplant failure as follows:						
[(1) In the case of 3-engine airplanes, maneuvering to a landing with an approved procedure that approximates the loss of two powerplants (center and one outboard engine); or			B*			
[(2) In the case of other multiengine airplanes, maneuvering to a landing with a simulated failure of 50 percent of available powerplants, with the simulated loss of power on one side of the airplane.			B*			
[Notwithstanding the requirements of subparagraphs (d)(1) and (2) of this paragraph, in a proficiency check for other than a pilot-in-command, the simulated loss of power may be only the most critical powerplant. However, if a pilot satisfies the requirements of subparagraphs (d)(1) or (2) of this paragraph in a visual simulator, he also must maneuver in flight to a landing with a simulated failure of the most critical powerplant. In addition, a pilot-in-command may omit the maneuver required by subparagraph (d)(1) or (2) of this paragraph during a required proficiency check or simulator course of training if he satisfactorily performed that maneuver during the preceding proficiency check, or during the preceding approved simulator course of training under the observation of a check airman, whichever was completed later.]						
(e) Except as provided in paragraph (f) of this section, if the certificate holder is approved for circling minimums below 1000-3, a landing under simulated circling approach conditions. However, when performed in an airplane, if circumstances beyond the control of the pilot prevent a landing, the person conducting the check may accept an approach to a point where, in his judgment, a landing to a full stop could have been made.			B*			
a(f) A rejected landing, including a normal missed approach procedure, that is rejected approximately 50 feet over the runway and approximately over the runway threshold. This maneuver may be combined with instrument, circling, or missed approach procedures, but instrument conditions need not be simulated below 100 feet above the runway.			B			

Maneuvers/Procedures	Required		Permitted			
	Simulated Instrument Conditions	Inflight	Visual Simulator	Non-Visual Simulator	Training Device	Waiver Provisions of §121.441(d)
VI. Normal and Abnormal Procedures. Each applicant must demonstrate the proper use of as many of the systems and devices listed below as the person conducting the check finds are necessary to determine that the person being checked has a practical knowledge of the use of the systems and devices appropriate to the airplane type						
(a) Anti-icing and de-icing systems				B		
(b) Auto-pilot systems				B		
(c) Automatic or other approach aid systems				B		
(d) Stall warning devices, stall avoidance devices, and stability augmentation devices				B		
(e) Airborne radar devices				B		
(f) Any other systems, devices, or aids available				B		
(g) Hydraulic and electrical system failures and malfunctions					B	
(h) Landing gear and flap systems failure or malfunction					B	
(i) Failure of navigation or communications equipment				B		
VII. Emergency Procedures. Each applicant must demonstrate the proper emergency procedures for as many of the emergency situations listed below as the person conducting the check finds are necessary to determine that the person being checked has an adequate knowledge of, and ability to perform, such procedure:						
(a) Fire in flight				B		
(b) Smoke control				B		
(c) Rapid decompression				B		
(d) Emergency descent				B		
(e) Any other emergency procedures outlined in the appropriate approved Airplane Flight Manual.				B		

Appendix G

Doppler Radar and Inertial Navigation System (INS): Request for Evaluation; Equipment and Equipment Installation; Training Program; Equipment Accuracy and Reliability; Evaluation Program

1. *Application, authority.*

(a) An applicant for authority to use a Doppler Radar or Inertial Navigation System must submit a request for evaluation of the system to the Air Carrier District Office or International Field Office charged with the overall inspection of its operations 30 days prior to the start of evaluation flights.

(b) The application must contain:

(1) A summary of experience with the system showing to the satisfaction of the Administrator a history of the accuracy and reliability of the system proposed to be used.

(2) A training program curriculum for initial approval under § 121.405 of this Part.

(3) A maintenance program for compliance with Subpart L of this Part.

(4) A description of equipment installation.

(5) Proposed revisions to the Operations Manual outlining all normal and emergency procedures relative to use of the proposed system, including detailed methods for continuing the navigational function with partial or complete equipment failure, and methods for determining the most accurate system when an unusually large divergence between systems occurs. For the purpose of this Appendix, a large divergence is a divergence that results in a track that falls beyond clearance limits.

(6) Any proposed revisions to the minimum equipment list with adequate justification therefor.

(7) A list of operations to be conducted using the system, containing an analysis of each with respect to length, magnetic compass reliability, availability of en route aids, and adequacy of gateway and terminal radio facilities to support the system. For the Purpose of this Appendix, a gateway is a specific navigational fix where use of long range navigation commences or terminates.

2. *Equipment and equipment installation—Inertial Navigation Systems (INS) or Doppled Radar System.*

(a) Inertial Navigation and Doppler Radar Systems must be installed in accordance with applicable airworthiness requirements.

(b) Cockpit arrangement must be visible and useable by either pilot mated at his duty station.

(c) The equipment must provide, by visual, mechanical, or electrical output signals, indications of the invalidity of output data upon the occurrence of probable failures or malfunctions within the system.

(d) A probable failure or malfunction within the system must not result in loss of the aircraft's required navigation capability.

(e) The alignment, updating, and navigation computer functions of the system must not be invalidated by normal aircraft power interruptions and transients.

(f) The system must not be the source or cause of objectionable radio frequency interference, and must not be adversely affected by radio frequency interference from other aircraft systems.

(g) The FAA-approved airplane flight manual, or supplement thereto, must include pertinent material as required to define the normal and emergency operating procedures

[Whereupon, at 4 p.m. the Ad Hoc Select Subcommittee on Maritime Education and Training of the Committee on Merchant Marine and Fisheries adjourned.]